



Technology and the Voting Process

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I.

Executive Summary

A. Mandate

Our purpose in this study was to provide the Chief Electoral Officer and his staff with a comprehensive examination of the implications of information technology for the voting process in Canada. This is a subject that legislators and citizens are beginning to explore seriously in many jurisdictions, both in Canada and abroad. The electoral process at the federal level in Canada is one of the most efficient and respected in the world, and Canada is among the most technologically-advanced countries. It is appropriate, therefore, that Canadian Parliamentarians should be in as good a position as possible to consider the issues raised by the new voting technologies and to assess their potential for improving the accessibility and efficiency of the voting process.¹

B. The environment

Our first task was to identify the forces and factors that have changed, or threaten to change, the environment in which elections are conducted in Canada, including changes in the attitudes, perceptions, expectations and voting habits of Canadians, and the effects of information and communications technology on that electoral environment. Our findings in this regard are set out in chapters IV, V and VI of this report.

We note that Canadians increasingly are using the new information technologies in many dimensions of their lives ranging from banking to shopping to gathering information and expressing their views. Moreover, a third to one-half of Canadians surveyed at the time of the last federal election indicated they would be prepared to use one or more of the new voting technologies. This finding was borne out in focus group discussions conducted in

¹ *We should emphasize that the focus of this study is on the potential application of new technologies to the electoral process supporting representative government in Canada – i.e., to our current parliamentary system. It was not our mandate to explore the possible implications of information technology for various forms of “direct democracy”. The new voting technologies are indeed being used for plebiscites and various kinds of elections outside government (e.g., political party conventions). But the technologies themselves are system neutral; they represent new ways of casting a ballot but they are not biased toward one form of electoral democracy versus another.*

conjunction with our study. We also found that Canadians see the new technologies as potentially increasing their choices in the timing and method of voting. That is, they regard electronic voting as a means of increasing the ease and accessibility of voting rather than as a wholesale substitute for the traditional method of balloting.

C. Voting technologies

Our second task was to examine the opportunities offered by the new voting technologies to enhance the accessibility of the voting process to Canadians. Our findings on these issues, including the modeling of selected voting technologies, are contained in chapters VII and VIII and Annex F of this report. In the course of assessing those technologies, we reviewed Canadian and international experience and found that the rhetoric of innovation in this area has so far greatly exceeded the results. Despite the talk, few jurisdictions have actually gone very far in implementing new voting technologies, though a number have launched pilot projects or at least made it legally possible to begin such experiments. *The key point here is that none of the new technologies has yet been adequately tested in a way that would satisfy the requirements of electoral democracy in Canada.*

D. Findings

In our review we examined a range of current voting technologies, including telephone, Internet, cable, kiosk and ATM (automatic teller machine) devices, portable data capture devices—both digital and cellular, smart cards and other personal identifier devices. We concluded that three technologies offer the greatest potential utility to Canadians because of their wide accessibility and public acceptance. These are the electronic kiosk, the telephone and the Internet. Accordingly, we focused our detailed examination on them. We modeled these three technologies against a detailed model of the current manual voting process. Summary descriptions of how the three electronic methods would work are provided in Chapter VII.

The most important general finding from this study is that the new technologies—and especially the selected three of electronic kiosk, telephone and Internet—offer the prospect of significantly improving both the accessibility and the efficiency of the electoral process in Canada.

We note that the route toward adoption of any of these new technologies contains a number of potential pitfalls and obstacles, including issues of security, cost, privacy and public acceptance. Nevertheless, we also found there is good reason to believe that the technological challenges posed by electronic balloting can be overcome, and there is no reason in principle why the stringent criteria for effective electoral administration set out in Chapter III cannot be met by at least some of the new voting technologies.

E. The integrity of the voting process

Central to the whole issue of technology and the voting process is whether Canadians can—and would—have confidence that use of the new technologies would preserve the integrity of the voting process in Canada, in all its dimensions. The seventeen criteria set out in Chapter III to ensure the integrity of the electoral process represent a high standard of systemic integrity. But it is important to bear in mind that no voting process—whether the present one or a new electronic form of balloting—can be perfectly secure. After all, the *current* electoral process in Canada is a complex system of law, procedures, practices and dedicated administration that involves not just the Chief Electoral Officer and his staff but also the many thousands of Canadians who are involved in the conduct of every election.

The integrity of the present system is something to which Canadians attach a high value. But the integrity of our electoral system also depends on what Canadians are prepared to accept as a reasonable standard of security and integrity. Canadians trust our present systems and procedures—what could be called our present “technologies”—because they are used to them, because they see that they work and because people accept that they will produce an honest result. Canadians also have taken for granted that our present system, as updated with such measures as the Special Voting Rules, has been reasonably accessible to voters. Whether this degree of accessibility will continue to be satisfactory to Canadians in the future, however, is an open question.

Similarly, the attitude of Canadians to the new technologies is changing as those technologies become ever more present in our lives, whether in the form of banking machines, or scanning devices at the checkout counter, or Internet commerce. People see that these electronic systems work, and they develop a reasonable degree of trust in them, despite the fact that any of these systems is open, both in principle and in fact, to some form of compromise.

The issue of public acceptance of new voting technologies, therefore, will depend ultimately on what kinds of technologies the members of the public use generally in their lives. It will also depend on people having seen the new voting methods tried and tested. It will depend on predictable reductions in the cost and acceptability of various means of assuring security and integrity in voter identification, a key issue for any proposal that involves “voting at a distance.”² It should also reflect the recognition that different technologies are best applied to different subsets of the population, whether the group in question is rural Canadians, or persons with disabilities, or simply those such as young people for whom flexibility and accessibility is a high priority.

² *If you cannot physically verify the identity of the voter, then you need some other means of assuring security that will also protect the secrecy of the actual ballot.*

F. Possible next steps

Elections Canada already has done much to apply information technology to the “background” processes that support electoral events. Parliamentarians may now wish to explore ways of using the new technologies to make the act of voting itself more accessible to Canadians. This exploration can be undertaken in several ways.

First, Parliament could make the necessary legislative changes to allow Elections Canada to test some of the promising technologies in controlled, pilot situations where electoral administrators can learn from experience, where Canadians can observe the new methods in action, and where Parliamentarians themselves can draw lessons about the directions in which they wish to proceed and at what pace. One simple way to do this would be for Elections Canada to commission the building of a “pilot” system, using a particular technology, so that Parliamentarians, and Canadians generally, could observe how it worked in a controlled environment such as a student election at a secondary school.

Second, Elections Canada can continue a dialogue on these issues with interested Canadians, including those with a professional interest in elections, those who supply technology, and those who speak for different sectors of our society for whom technology offers particular benefits in terms of accessibility to voting.

Third, there is probably work to be done in educating the public at large on the benefits of the new technologies and their application to the electoral process.³ Only if the public is fully informed will it be prepared to support changes to something as important as the process of voting in a federal election.

Fourth, there would be merit in Elections Canada continuing to monitor technological developments in this area, and perhaps to fund appropriate research in electoral technologies and their application to voting processes in Canada and abroad. Elections Canada is Canada’s “centre of excellence” in these matters; it should continue to invest in its knowledge base and expertise on technology and the voting process so that Parliamentarians, and Canadians generally, have the benefit of up-to-date information and advice.

G. A final word

Our study suggests that the new technologies are unlikely to replace our current methods of voting in the near future. Canadians appear to want choice, not a dramatic change, in how elections are conducted or votes are cast. But as the information revolution permeates more and more aspects of our daily lives, and as Elections Canada strives to

³ *The results of the focus groups revealed that some sub-groups are less keen than others about the current voting options.*

ensure the electoral process remains relevant and accessible to all Canadians, it is reasonable to assume that some steps in the direction of electronic voting are inevitable.

As we see it, the challenge and the opportunity for Parliamentarians is to ensure that the potential benefits of the new voting technologies are secured for Canadians, without in any way compromising the integrity of the voting process or the confidence of Canadians in their electoral system. The findings in this study suggest clearly that this objective can be achieved, provided it is pursued with care and prudence, on a controlled basis, under the direction of Parliament.

II.

Introduction

A. Our mandate

This report is the final output of the study conducted by KPMG and Sussex Circle under contract to Elections Canada. The object of the study was to identify the forces and factors that have changed, or threaten to change, the environment in which elections are conducted in Canada. These include changes in the attitudes, perceptions and voting habits of Canadians in the context of advances in information and communications technology and the opportunities they offer to enhance Canadians' accessibility to the voting process.

Our goal was to provide an analysis of issues relative to the electoral process that will face Parliament over the next decade and a perspective on how accessibility to the voting process might be enhanced using emerging voting technologies.

We were asked to identify options to improve access to the act of casting a vote, rather than the steps which lead up to that act such as registration or the activities which result from that act such as tabulation of the vote. Although we addressed accessibility issues that may affect participation, we did not address the general question of voter participation or attempt to draw conclusions about voters' attitudes toward the voting process in Canada today.

In the course of the study, we produced three interim reports. The first, *Background Report and Workplan*, dealt with the changing attitudes, perceptions and voting habits of Canadians, recent recommendations for, and reforms to, the voting process, the effects of information and communications technology on society and government generally, and the voting process specifically. The second, *Technology Progress Report*, provided an overview of the technological applications currently being employed throughout the world for the voting process, modeled the key steps in the current voting process, identified technologies, or families of technologies, which are being used in various industries which could be applied to the voting process; and modeled telephone and the

Internet-based voting options.⁴ The third, *Technology Assessment Report*, included additional voting technology case studies and assessments of the administrative systems, legislative regimes, political culture and “voting process” issues in each case. It also reported on consultations with leaders of technology firms regarding technology trends, constructed detailed models for each of the three selected voting technologies, provided impact assessments of the various voting technologies across electoral stakeholder groups, and provided an assessment of the modifications to the *Canada Elections Act* that might be required to allow for pilot testing and full implementation of the various voting options.

The present report draws together the key findings from the interim reports, as well as those from three roundtable discussions convened by the Public Policy Forum with stakeholder groups—Members of Parliament and Senators, persons representative of voting groups that have a major stake in the use of new technologies for electoral purposes, and selected opinion leaders. It also provides our assessment of the organizational and administrative requirements for Elections Canada, as an organization, to successfully manage the various voting technologies.

We can conclude from our survey of Canadian and international experience that electronic voting is still very much in its infancy—not just in Canada but everywhere. There is growing interest in a number of technologies and an increasing willingness on the part of governments at all levels to experiment with them. But, at time of writing, there is no jurisdiction that we are aware of where new technologies have been widely adopted as a regular part of the ensemble of tools for the voting process.

Elections Canada has completed considerable work toward the automation and computerization of work processes in order to improve the efficiency and accuracy of the electoral process and to improve service to its clients. These innovations include, among others, the National Register of Electors (a permanent, automated, and regularly updated list of voters which replaces enumeration and facilitates the shortening of the electoral calendar), the Event Management System (which electronically links all returning officers to Elections Canada headquarters and facilitates the timely and effective transmission of electoral data to the agency) and Elections Canada’s web site (which provides a wealth of information for Canadians, including electoral results on election night).

For many Canadians, for the foreseeable future, the act of voting will continue to be carried out by hand, at a polling station in a school or a church hall, in a manner that is easily recognizable. Yet, for an increasing number of Canadians, technology offers the prospect of supplementing the traditional system in ways that make the electoral process more accessible and more efficient for them.

⁴ We later modeled a third key voting technology—electronic kiosks.

Electronic voting is a natural next step in the introduction and application of new technologies to the electoral process. Our survey of technologies and voter attitudes has convinced us that barriers to the introduction of new voting technologies are lower than might be expected and that many Canadians have an interest in using—or at least having access to—the new technologies. Provided that the integrity of the electoral process is respected in the application of any new procedures, we see many reasons and benefits to consider pilot projects with these technologies as part of Parliament’s continuing effort to ensure fair and accessible electoral administration in Canada.

B. Background to this study

1. Royal Commission on Electoral Reform and Party Financing

The Royal Commission on Electoral Reform and Party Financing was established in November 1989 with a mandate to inquire into and report on the appropriate principles and process that should govern the election of members of the House of Commons and the financing of political parties and candidates’ campaigns.

The Commission’s establishment and mandate were dictated largely by the major constitutional, social and technological changes over the past several decades and their concomitant influence on Canadians’ expectations of the political process itself. Asserting that it was not enough to assume that the Canadian electoral process will always meet the standards of being a fair and democratic process and that the process is not open to any improvements, the Commission emphasized that the process and the national government must be seen as legitimate.⁵

In its second volume, entitled *Reforming Electoral Democracy*, the Royal Commission on Electoral Reform and Party Financing presented its recommendations for reforms to the voting process. It was the Commission’s objective to “ensure that no Canadian voter be deprived of the right to vote because of the administrative aspect of voting procedures.”⁶ The Commission also noted that research indicates that electoral systems that make it easier for voters to exercise their franchise, enjoy higher voter turnout.

To this end, the Commission’s major recommendation regarding the voting process was to extend Special Voting Rules to all Canadians by introducing a special ballot. The

⁵ *Royal Commission on Electoral Reform and Party Financing, Reforming Electoral Democracy; Volume 1 Final Report, 1991.*

⁶ *Royal Commission on Electoral Reform and Party Financing, Volume 2 Final Report, 1991. P.41.*

Commission recommended the special ballot to serve a variety of voters with special needs and provide an alternative for voters unable to get to an ordinary or advance poll.

At the time the Commission made its recommendation, Special Voting Rules were only granted to members and certain employees of the Canadian Forces and public servants posted abroad and their spouses and dependents, veterans in certain hospitals, and members of the Canadian Forces in Canada. The Commission felt that the special ballot would provide a more flexible option to voters who could not go to an ordinary poll.

While that recommendation does not directly advocate the utilization of new technologies to improve accessibility to the voting process, the Commission's supporting reasoning does offer useful insight into their recommendation. "The Canada Elections Act must not impede the appropriate use of new technologies in the electoral process as they become available; this will help to ensure that the voting process remains user friendly and cost effective. Specific developments in communications technologies may be difficult to anticipate, however. The Act should not freeze voting and other election procedures at the level allowed by current technologies; but at the same time the integrity of the electoral system must be maintained."⁷

We believe this recommendation captures rather eloquently the fine balance that must be maintained in considering the introduction of new voting procedures, including new technologies.

2. The Chief Electoral Officer's 1996 and 1997 Reports to Parliament

In his report to Parliament of February 28, 1996, following the 35th General Election, the Chief Electoral Officer (CEO) echoed the 1991 recommendation of the Royal Commission on Electoral Reform and Party Financing to the effect that the *Canada Elections Act* should not impede the appropriate use of technologies in the electoral process as they become available. The CEO called for a wide-ranging series of amendments to the Act, including a request for authority to conduct pilot projects to test new electoral procedures after consultation with the Committee of the House of Commons responsible for electoral matters. That recommendation has yet to be addressed by Parliament.

In his 1997 report to Parliament following the 36th General Election, the CEO highlighted a number of electoral innovations aimed at utilizing technology to deliver high-quality and efficient service to Canadians. Most notable was the creation of the National Register of Electors.

⁷ *Royal Commission on Electoral Reform and Party Financing, Reforming Electoral Democracy, Volume 2 Final Report, 1991. P.76.*

C. Approach taken in this study

The present study attempts to increase understanding of new voting technologies and their implications for electoral administration, by building on three bodies of work:

- the research and recommendations of the 1991 Report of the Royal Commission on Electoral Reform and Party Financing;
- the various recommendations and initiatives of the CEO in recent years aimed at increasing the accessibility of the voting process; and
- a number of specialized studies, both academic and internal to Elections Canada, that address various dimensions of the issue of technology and electoral democracy.⁸

This report attempts to explore both the issues and the new technologies, in the context of the changing attitudes and expectations of Canadians about the electoral process, and about the act of voting, in particular. We present our findings regarding the viability of the various generic technologies, with an emphasis on three that have been identified as most relevant and promising for Canada. Finally, we offer an assessment of the implications of the adoption of the new technologies for electoral administration, in light of the seventeen criteria for electoral administration that are listed in the next Section.

⁸ *The academic studies are cited at various points in the report. Selected data from the 1997 Canadian Election Study was of greatest immediate relevance to our work. We are grateful for the access we were given by Elections Canada to selected elements of that survey. The full results are confidential to its authors until June, 1998. The study was primarily funded by the Social Sciences and Humanities Research Council and was coordinated by André Blais (Université de Montréal), Elisabeth Gidengil (McGill University), Richard Nadeau (Université de Montréal), and Neil Nevitte (University of Toronto). An internal Elections Canada study of particular assistance was the 1997 report by Christa Scholtz on the current state of electronic voting options. We wish to express our appreciation for access to the study. See Scholtz, Christa, *Electronic Voting: Preliminary Research and Recommendations*; July 23, 1997.*

III.

Criteria for Effective Electoral Administration

The fundamental criteria for the successful administration of the voting process remain the same, regardless of the chosen voting mechanism. In our analysis of electronic voting options we tested each of the options against the following seventeen fundamental criteria that were derived from discussions with Elections Canada officials.

1. **Democracy**—one eligible voter can cast one vote
2. **Accuracy**—the final vote count reflects the intent of voters
3. **Security**—measures are in place to protect the integrity of the process
4. **Secrecy**—no vote can be traced to the voter
5. **Verifiability/auditability**—the vote results can be verified after the initial count
6. **Privacy/confidentiality**—information collected on electors is used for election purposes only and within the scope for which it was collected
7. **Transparency**—the process is open to outside scrutiny
8. **Accessibility**—the reasonable, specific needs of eligible electors are taken into account so that none are disenfranchised
9. **Neutrality**—electoral processes or materials do not favour one candidate or party over another
10. **Simplicity**—the voting processes do not make voting unduly complicated

Additional criteria that can particularly be applied to electronic forms of voting are:

11. **Flexibility**—the voting process can handle a variety of ballot styles and counting formats

12. **Scalability**—the voting process can be scaled to handle large and small electoral events
13. **Recoverability**—the voting process provides for duplication of systems to prevent data loss
14. **Mobility**—the voting process provides the ability for votes to be cast from locations other than the traditional polling station
15. **Speed of count**—results can be reported quickly
16. **Cost-effectiveness**—the voting process is effective and economical
17. **Technical durability**—the voting process allows the basic electoral infrastructure to be reasonably insulated from obsolescence

One could say that the first ten criteria speak directly to the interests of *voters* in the integrity of the ballot process, while the last seven speak more to the interests of the *electoral administrator*.

Together, these seventeen criteria make up a multi-dimensional baseline of adequacy for any proposed voting procedure, electronic or otherwise. It would be difficult to imagine a jurisdiction adopting a new technology for voting if it were not satisfied that the proposed innovation was at least as good as the present system on every one of the first ten criteria, and better than the present system on the last seven.

In Section VIII of this report we provide a detailed discussion of how the criteria could be met in practice for different voting processes.

IV.

Technology and Electoral Democracy: The Changing Environment

This section provides an overview of the effects of information and communications technology on society and government followed by a summary of research conducted by Elections Canada and ourselves. It concludes with an overview of Canadian and international electronic voting experiences.

A. Technology, society and government

The world economy is undergoing a technology-driven transformation comparable with the shift from an agrarian to an industrial society. The move from an industrial, physically-based economy, to a digital, knowledge-based economy is causing a rethinking of processes in many sectors. We should therefore view demands for electronic solutions to increase accessibility and participation in the electoral process as part of the general influence of technology on our society as we approach the millennium.

Canada and many other countries are exploring how to introduce government-wide electronic information infrastructures to simplify service delivery, reduce duplication, and improve the level and speed of service to the public at a lower cost for the taxpayer. Such information infrastructures are similar to those which Canadians use daily in the financial and commercial sectors.

Networked computer technology also offers an opportunity for interactive forums where citizens can ask questions, make suggestions, give opinions, and even vote on issues. Networks offer an opportunity for groups of citizens with similar interests, who otherwise would not be able to communicate with each other, to come together to discuss their views and interests raising the debate over representative versus direct democracy.⁹

⁹ *While the purpose of this report is not to debate representative versus direct democracy we are aware that it is a significant issue which must be addressed in further examination of the possible impacts of technology and the voting process on Canada's system of democracy.*

The intense pace of technological change requires public administrators to carefully consider what, when and how to implement technological solutions. Financial restraint and increased accountability have increased the acceptance of automation in order to improve services and reduce costs; however, there is little acceptance of technological changes which do neither, or do so only marginally.

B. Research on electronic voting

1. Technology and the democratic process

To date, the greatest academic and political interest has been the current and potential application of technologies to increase participation of the electorate in civic life and the political process by circumventing real or perceived obstacles to political participation. This has revived the debate over representative versus direct democracy. The supporters of representative democracy question the effect direct democracy would have on the notion of majority rule versus minority rights, while the proponents of direct democracy champion greater citizen involvement in the decision-making process.

The principal area of interest to Elections Canada, however, and the focus of our study is the possibility of utilizing technologies to increase *access to the voting process*, rather than to issues such as democratic participation and citizen involvement.

2. Demands for change

From the perspective of electoral administrators, the characteristics of current electoral systems¹⁰ that encourage examination of electronic voting options include: limitations to access; increasing difficulty of staffing polling stations with qualified workers; problems with irregular vote counts or rejected ballots; increasingly complex ballots; unacceptably long counting times; the ability of electronic voting devices to support multiple languages; and difficulties transmitting results to electoral stakeholders.

In cases where accessibility is a key impediment, the application of new technologies to the voting process holds particular appeal. For example, seniors, persons with disabilities, members of ethno-cultural communities, those in isolated communities and people who are out of the country all stand to benefit from these technologies. The Scholtz study

¹⁰ *Some of these characteristics do not appear to be applicable at the federal level including: problems with irregular vote counts or rejected ballots; increasingly complex ballots; and, unacceptably long counting times.*

noted¹¹ that electors for whom accessible transportation to the polling station, or the physical accessibility of the polling station, is a problem, expressed more interest in voting methods allowing them to stay at home (vote by mail, vote by telephone, or vote by Internet). These opinions were shared by those in remote communities.

Canadians also indicated a willingness to explore alternative forms of voting in their responses to questions in the 1997 Canadian Election Study. Elections Canada commissioned a number of questions in the study in an attempt to determine the extent to which Canadians were receptive to the idea of electronic voting and various other voting alternatives. Respondents were asked a series of questions about their willingness to use five different methods of voting—by mail, by telephone, by (personal) computer, by touch screen computer (such as those used in some automated teller machines), and employing a counting machine¹².

In terms of the technological options, 54 percent of respondents expressed a willingness to vote using a touch screen computer, 36 percent indicated a willingness to vote by telephone, and 29 percent by computer. With respect to preferences, respondents preferred the touch screen computer (37 percent) over the telephone (26 percent) and personal computer (18 percent).

Our assessment of Canadians' willingness to explore such options was bolstered by the findings of the roundtable convened by the Public Policy Forum with electoral stakeholders representing individuals with low literacy skills, with physical disabilities, with visual and hearing impairments, the elderly, new Canadians, and aboriginal groups. Each representative was asked to assess three potential technologies—voting by telephone, by computer, and by touch screen computer. Overall, these stakeholder groups were enthusiastic about the options so long as they were easy to understand and did not limit their options either in terms of which technology they wished to use, or whether they wished to use the traditional voting process.

Furthermore, a study conducted by Market Explorers Incorporated between April 1-5, 1998 in the Port Moody Coquitlam electoral district of British Columbia found that 73 percent of respondents thought that it was not very or not at all important to vote in a polling station if other convenient options were available. 502 electors were interviewed by telephone following the Port Moody Coquitlam by-election by Market Explorers for this study.

¹¹ Scholtz, Christa, *Electronic Voting: Preliminary Research and Recommendations*; July 23, 1997.

¹² *Vote counting machines were not considered in our study because they are primarily used as a tool to assist in vote tabulation.*

3. Cost factors

Several factors affect the cost effectiveness of electronic voting options. These include the size of the voting population, the frequency of electoral events, and the number of items on the ballot. There are also several factors which impact on the criteria for effective electoral administration, including security, transparency, and democracy.

It is also clear that measures to ensure that the tenets of effective electoral administration are upheld will have an impact on cost. For example, while telephone, personal computer, and touch screen computer technologies can increase accessibility, by taking voting out of the polling station they create a host of issues with respect to verification of an elector's eligibility to vote. With these technology options, verification is achieved through the use of some sort of personal identifier, typically a personal identification number (PIN) like that used for bank cards. The key issue this type of verification raises is ensuring that the right PIN gets to the right elector and it is in fact that elector who uses the PIN to exercise their right to vote.

A number of options to deal with this issue are available including voice prints (for voting by telephone), fingerprinting, retina scanning, and smart cards. However, each of these options is costly and raises a number of privacy issues. This is not to say that it is an insurmountable problem. Technologies to address the verification issue are available and will likely become more cost effective in the next few years. As for privacy-related issues, just as it is incumbent on the Office of Chief Electoral Officer to understand Canadians' willingness to explore other voting options and to report these to Parliament, it is also the Office's role, and generally that of government, to be aware of the extent to which Canadians accept the use of such personal identifiers.

4. Supply of electronic voting tools

Because of the remarkable progress of telecommunications technology and penetration of telecommunications equipment in Canadian households,¹³ interest has increased dramatically in the potential impact of technology on democratic norms and processes. Telephone, cable and the Internet are being advanced as the new tools for political communication, mobilization and representation.

The most commonly identified electronic voting tool is the telephone because of its near universal availability in Canadian households and its potential to alleviate barriers to voting posed by geography or physical accessibility. However, early attempts at televoting in Canada have highlighted the importance of systems capacity (e.g., handling the volume of calls) and the importance of proper development methodology and

¹³ *Specific examples of telecommunications equipment include touch tone telephones (cellular and land based), computers equipped with modems and interactive television through cable.*

standards including acceptance and systems testing. Other keys to success are the integrity of the list of voters and a series of dependent controls tightly maintained and monitored (PIN generation, distribution, verification, vote casting, vote tabulation and vote dissemination).

Interest in voting using the Internet is also increasing. However, while the infrastructure to support such a venture is available, security remains a major consideration because of the “electronic pipeline” between the user and the centre (the user terminal and Internet Service Provider) which can be monitored, tapped, intercepted and substituted.

The greatest challenge which electronic voting options must overcome is that of transparency. Because fully electronic systems rely completely on the technical knowledge of systems administrators and auditors to ensure election integrity, the safeguard of direct transparency to “ordinary citizens” is virtually impossible to achieve.¹⁴

5. Technologies investigated in this project

Our investigation of voting technologies included: telephone, Internet, cable, kiosk and ATM (automatic teller machine) devices, portable data capture devices—both digital and cellular, smart cards and other personal identifier devices.

Based on consultation with Elections Canada officials, leading technology firms (listed in Appendix C), the results of the 1997 Canadian Election Study, and the Public Policy Forum’s series of roundtables with electoral stakeholders, we focused our modeling efforts on the telephone, Internet and electronic kiosk voting.

¹⁴ Scholtz; *op.cit.*, page 15. As Scholtz notes, “instead of relying on ordinary people from political parties watching each other perform routine election duties, computerized systems require trust in individual technicians performing arcane technical tasks—few ordinary citizens have been initiated into the mysteries of source codes, programs and computer operations”.

V.

Experience with Voting Technologies

A. Canadian experience

1. Televoting in Canada

The Canadian experience with electronic voting options has been limited largely to municipal elections and provincial political party leadership selection. At the provincial and federal electoral levels a number of factors have served to moderate the administrative demand for shifts to electronic voting: the infrequency of electoral events, the relatively small population densities throughout most of Canada, and the fact that only one electoral contest is held per event.

2. Provincial political party leadership conventions

Several provincial political parties have used televoting (voting by telephone) to choose their leaders. The reason given was generally the attempt to increase participation to reflect the democratic norms of party memberships. Participation generally increased but participation rates in such contests are also dependent upon the relative competitive position of the party and the openness of the process in terms of rules adopted.

Concerns with televoting to date have included the ability of the telephone network to handle the peak period volume of calls, the technical capability to trace votes through PIN matching techniques, PIN-based fraud, the reduced sense of political community and possible coercion and intimidation.

Canadian political parties have utilized televoting on four occasions for the selection of party leaders—the Liberal Parties of British Columbia, Nova Scotia and Alberta and the Saskatchewan Progressive Conservative Party. Below we provide information on the Nova Scotia Liberal Party Leadership contest, one of the earliest examples of televoting in Canada.

A study of the Nova Scotia Liberal Party Leadership Contest conducted by Ian Stewart, Agar Adamson and Bruce Beaton from Acadia University suggests that the use of

televoting for the contest not only altered the size but composition of the electorate. As the authors note, “the number of eligible voters in 1992 was almost four times what it had been six years previously...(and) it is not implausible that certain types of individuals, who would have been unlikely to participate had the Liberals held a traditional leadership convention, were effectively enfranchised by the new procedures. Specifically, the convenience of being able to vote at home should have encouraged the participation of disproportionately more people from the furthest reaches of Nova Scotia.”¹⁵

Stewart, Adamson and Beaton draw three conclusions from the Nova Scotia leadership experience:

- (1) that the process was remarkably open—if voters paid the requisite fees they could vote—raising concerns over tactical voting as in American states which feature cross-over primaries (where individuals can be registered to vote for leadership contests in more than one party);
- (2) that there are legitimate concerns over televoting security—individuals could vote as many times as they had PINs; and
- (3) that although televoting does provide ease of access, 56 percent of party members did not vote.¹⁶

This third conclusion can be explained as the result of a number of factors from the registration fee to member apathy. Nevertheless, it is an important reminder that electronic voting options should not be pursued as a solution to voter apathy and disillusionment but rather as a means of improving accessibility and providing voters with more options for casting their decision.

While the televote ended successfully, it had to overcome a number of hurdles including a complete systems failure on the first attempt as a result of system capacity issues.

After the initial failed attempt at the Nova Scotia Liberal Party Leadership Contest, KPMG was engaged by the Liberal Party of Nova Scotia and the supplier—MT&T Technologies to (1) determine whether the system could be structured to provide integrity, completeness and confidentiality and if so, (2) conduct a review and issue an opinion on the adequacy of control procedures, and finally (3) audit and express an opinion on the vote results.

¹⁵ Stewart, Ian, Adamson, Agar and Bruce Beaton; *Pressing the Right Buttons: The Nova Scotia Liberals and Tele-Democracy*, in Stewart, Ian; *Roasting Chestnuts: The Mythology of Maritime Political Culture*, UBC Press, Vancouver, 1994.

¹⁶ *Ibid.*

KPMG confirmed that an appropriate system could be structured, and subsequently issued opinions on the adequacy of control procedures and the contest results. Subsequently, KPMG updated the opinions for each use of the televoting system and issued an opinion on each of the vote results. One of the subsequent leadership contests was reported to have had technical problems—which in our view were directly related to a lack of consistent application of predefined procedures outside of the technical components of the televoting system.

The result of Canada’s four provincial leadership contests are consistent in that they all eventually worked. However, all of these contests required significantly more planning in advance of the contest than originally anticipated by some of the organizers. Generally, those contests that were well planned and included comprehensive procedures and guidelines were executed with very few problems. Inadequate planning, testing and failure to consistently apply necessary procedures resulted in difficulties for two of the contests.

The use of televoting and in fact most technologies requires a consistent and well structured process, with well pre-defined and described deviations and their resolutions.

3. The experiences of Canadian municipalities

A number of Canadian municipalities are using electronic vote counting systems. The reasons include: new complexities in electoral processes, increases in the number of electoral contests per event, difficulties in recruiting and training polling workers, onerous manual counting processes, decreasing operating budgets, and controversy over rejection of ballots.

It is possible that some of these same factors will lead municipalities to explore electronic voting options as well.

For example, the City of North York held a telephone referendum on the Metro-Toronto amalgamation. The referendum administrators found that a telephone referendum could be successfully conducted in a municipality containing 400,000 voters, that it could be conducted in a number of languages, that confidentiality of the vote can be guaranteed, that the vast majority of the public can use the system, and that a telephone referendum can be conducted for about half the cost of a regular election.¹⁷

The North York experience identified three possible challenges to future use of telephone referendum and voting. The use of this technology requires some form of unique identifier to qualify a voter. The use of a 10 digit PIN was selected—and such an

¹⁷ *The televote cost \$2.20 per vote cast, or \$1.11 per eligible voter.*

identifier was distributed to qualified voters by mail. Some qualified voters living in multi residential complexes (apartments) reported that they failed to receive their PINs. There was some speculation that PINs were stolen and inappropriately used.

A second problem arose from the volume of callers which exceeded the capacity of the telephone system as it was configured. Some experience was gained regarding the time of calls, the type of telephone used by callers and the duration of calls. This experience subsequently was used to better tune the system.

Finally, some businesses raised the concern that their access to the telephone system supporting their businesses (telephone orders, credit card authorizations, etc.) could be compromised by the system load of a televote.

4. Electronic voting at the provincial level

A move from manually counted ballots to the use of electronic voting or vote tabulation is generally not seen as feasible by provincial governments at this time. There is not yet a clear need to implement new systems from the current electoral demands placed on voters (approximately once every four years) in a “first-past-the-post” system with uncomplicated ballots (unlike longer, more complicated municipal ballots). These make the electoral process at both the provincial and federal levels relatively simple.

In addition to this lack of clear need, some provincial administrators profess skepticism as to the accuracy and security of electronic voting means¹⁸. Another key obstacle for provincial administrators is the magnitude of the up-front development and capital costs which are associated with such a venture. This underscores the importance of partnerships between provincial electoral agencies and Elections Canada.

5. Canadian universities

In the Summer of 1997, the University of Calgary Student Union was approached by a Calgary-based firm called Voting Systems International (VSI) which was interested in finding a venue to test its voting technology. In the Fall of 1997, VSI carried out student government by-elections for free using its touch screen terminal voting technology. Based on the success of the by-election, VSI carried out the general student government election in February 1998, for a nominal fee of \$3,000. VSI had an opportunity to test its technology, while the University dramatically decreased the number of spoiled ballots and increased the speed of counting ballots. The use of the technology did not increase voter participation; however, a random survey of voters indicated the ease with which people used the system.

¹⁸ Scholtz, Christa, *Electronic Voting: Preliminary Research and Recommendations*; July 23, 1997.

VSI's electronic voting system uses touch screen terminals supported by laptop computers which store voting results. Votes cast using the terminals are transmitted to the laptops using low frequency radio waves. The results can either be stored electronically on each individual laptop and then downloaded periodically, or transmitted in real time (or periodically) to a central computer.

In the University of Calgary situation, the process commenced with potential electors presenting themselves to the polling clerk, telling the clerk their student number and presenting some form of picture identification. The student number was used to activate the elector's ballot, a ballot which would be different depending on the elector's course of study and faculty (electors voted for council executive as well as faculty representatives). The ballot was then transmitted to one of a number of touch screen terminals set up behind cardboard partitions much like traditional polling booths. The system prompted electors for their responses and allowed electors to change their ballot before submitting it. When the ballot was submitted, it was transmitted back to the laptop and the result stored electronically. At the time of submission, the identity of the elector was separated from the ballot.

Following the event, the system is capable of printing off a number of reports including the results and whether or not an elector voted more than once by visiting different polling stations. Because there was more than one polling station, and the system was not connected in real time, it was possible for an elector to vote more than once. If election administrators had found that someone has voted more than once, the university could have enforced a number of penalties of varying severity. VSI notes that this problem can be mitigated by connecting the polling stations and the real time transmission of who has voted to all polling stations.

B. International experience

Our survey of international experiences has led us to the conclusion that electronic voting is still in its infancy.

While there are numerous examples of jurisdictions which employ various technologies for the purposes of vote tabulation, examples of organizations (e.g., political parties, broadcast companies) which employ technologies like the telephone for the casting of decisions or opinions, and evidence that various jurisdictions have researched electronic voting, there are very few examples of jurisdictions which are planning to employ technology in the act of casting a vote and even fewer which have successfully done so. There are fewer still examples where the use of technology from remote locations (i.e., from locations other than the polling station like home or office) is planned. However, there are also a number of firms which are developing and marketing voting technologies

or products which support the feasibility of electronic voting such as encryption software and verification tools.

Below we present some interesting cases from our research.

1. Brazil

For mayoral and county representative elections in 1996, 33 million Brazilian voters made use of laptop computers in polling stations to record their votes electronically. Electronic voting involved 52 of Brazil's largest cities including the 26 county capitals and 26 other cities with voting lists of more than 200,000 electors.

The Brazilian Federal Superior Electoral Tribunal, which oversees election matters, introduced electronic voting as a means of reducing fraud and increasing the speed of the vote count (from 30 days to approximately six hours).

The electronic voting system was built by Unisys Brazil. Despite security and integrity concerns around electronic voting, electoral administrators view the system as far better than the conventional paper-based balloting once marked by long waits to vote, frequent recounts, and ballot box fraud.

The system runs off small computers, like laptops, specially fitted with numerical keypads and three large keys in different colours (all keys have Braille for blind voters). Each candidate in the election has a code number, which the voter enters into the computer after registering with the supervisor at the polling station. A picture of the selected candidate appears on screen, complete with details regarding party affiliation. The voter then uses the coloured keys to confirm the choice, correct the choice, or decide not to make a choice.

Each computer stores details of the votes recorded on a disk using double encryption. The computer does not store the identity of voters. At the end of polling day, the disks are sealed and transported to local consolidation centres for computation. The results are then transmitted to the Federal Electoral Court in Brasilia.

2. Belgium

The Belgian electoral system is one of proportional representation.

To increase the speed of the count and the ease with which voters cast their decisions, since 1985, a small firm from San Diego, California called dZine has been developing a number of prototypes for the Belgian government which employ light pen technology and standard personal computers (employing standard software packages such as Windows).

Electors cast their decisions by using the light pen (much like one would use their finger with a touch screen kiosk) to mark their selections on the computer screen.

In 1985, the government contracted dZine for a pilot project of 60 machines. Since then, the government has undertaken a long and detailed testing process and has tendered for electronic voting systems for several regions of the country using the light pen-standard personal computer design. The technology is used in both local and regional elections.

The “light pen” voting process unfolds as follows. Electors present themselves to the polling clerk at the polling station at which point their eligibility to vote is confirmed. Once confirmed, the elector is given a credit card-size card and directed to one of many terminals located in the polling station. Electors cast their decisions on the screen using the light pen, and then have a choice of either sending their decisions to the system or changing their vote. At the same time as the elector sends their decision to the central electronic repository, the elector also sweeps the card they were given at registration through the personal computer’s card sweeping device. This action stores the decision on the card as well. Then, the voter deposits this card in the traditional ballot box. Sending the decision electronically to the central repository facilitates the speed of the count while storing the information on the card which is then submitted in the traditional ballot box provides a back-up means of verifying the count.

3. Bosnia

The Centre for Information Law and Policy (CILP), a joint effort between the Villanova University School of Law and the Illinois Institute of Technology’s Chicago-Kent College of Law, recently formed a “Project Bosnia” team which worked toward the establishment of an Internet-based voting system in Bosnia.

The Dayton Accords, which brought an end to the fighting in Bosnia, allow all Bosnian voters to vote in the elections of their home region. This includes those voters who had been displaced from their home regions during the war. In an effort to alleviate the tension that would result from voters returning to land occupied by former enemies on election day, the CILP team began working on a system that would allow voters to cast ballots using the Internet. As a preliminary trial, Villanova Law School developed an Internet-based voting system that the school used for internal student elections. Although the Bosnian Internet-based voting system has not advanced much beyond the planning stages, the CILP team attracted the attention of the International Foundation for Election Systems (IFES) which was working with the Government of Costa Rica on an Internet-based voting project.

4. Costa Rica

IFES had been working with the Government of Costa Rica on the possibility of Internet-based elections. In the Summer and Fall of 1997, members of the CILP team went to Costa Rica to meet with government officials about the possibility of providing assistance to this end. The Costa Rican Supreme Electoral Tribunal agreed to the idea of planning and testing an Internet-based election system.

One of the key challenges for the Costa Rican Supreme Electoral Tribunal is that only about 65 percent of qualified Costa Rican citizens go to the polls. In part, this is because citizens typically do not register to vote any place other than where they originally registered when they reached the age of 18. At election time many eligible voters must decide whether to travel in order to vote or not vote at all. As a consequence, political parties spend millions of dollars each election year to bus voters to polling stations or to supply them with gas money to get to wherever they happen to be registered leaving the Costa Rican system unduly exposed to inducements and coercion.

The CILP team offered to address this key challenge as follows.

1. The team would set up five to ten test polling stations where constituents could vote both manually and electronically. Training would be completed on-site for voters who needed it.
2. Citizens would be able to vote at their local public school, and would not have to travel to the place where they were registered to vote. Locally registered voters would use the manual process, while those who were registered elsewhere would vote electronically.
3. Each “electronic” voter would present an identification number to someone at a registration desk, and the registration clerk would enter that voter's name into a computer at each polling station. The Internet would then be used to verify that that voter has not actually voted before, and also to deliver the appropriate ballot for that voter.
4. The electronic interface would show photographs of the various candidates and their party flags, and be supported by either a touch screen or a light pen for voters to choose the candidate of their choice.
5. Votes would be transmitted electronically, over the Internet, to a central server run by Project Costa Rica and AT&T on behalf of the Electoral Tribunal.

The benefits of such an approach were to include reduction of voter fraud and political coercion, increased voter participation, and improved electoral administration efficiency.

The CILP team also proposed the possibility of making registration functions available over the Internet.

However, Internet-based voting is yet to be introduced in Costa Rica because of political opposition (the government did not feel comfortable about the level of system security) and also because of the country's political culture (election day is seen as a national holiday, a day on which people travel to their home cities, towns or villages to visit friends and family).

5. State of Florida

In October of 1997, the State of Florida announced an initiative to provide voting via the Internet for 1998 state elections. Internet voting is to be offered as an option to overseas military and civilian voters as a means of alleviating the time constraints of the current mail-based, absentee voting system and in so doing allow for greater participation.

Internet voting will be similar to Florida's current absentee voting system. An overseas voter will request an authorization to vote via the Internet. Upon receipt of this authorization, the voter will complete a virtual ballot on his/her computer terminal. The vote will be registered instantly with the supervisor of elections, without the present fear of loss in overseas mail.

To date, these enabling provisions have not been tested in an electoral event in Florida.

VI.

Canadians' Attitudes to New Voting Technologies

A. 1997 Canadian Election Study

Elections Canada commissioned a number of questions in the 1997 Canadian Election Study aimed at determining the extent to which Canadians were open to the idea of electronic voting and various voting alternatives. Respondents were asked a series of questions about their willingness to use, and preferences among, five possible methods of voting. The methods of voting were mail, telephone, computer, using a touch screen computer, and using a counting machine.¹⁹

The main findings are summarized below.

1. Vote by mail²⁰

Overall 31 percent of survey respondents indicated a willingness to vote by mail, with respondents aged 18-24 most willing to use this method (40 percent). Fewer unemployed (30 percent) and retired (20 percent) persons were willing to vote by mail, in comparison to students or homemakers (36-39 percent), and only 22 percent of persons with a disability were willing to vote by mail. Voting by mail was the most likely method for 20 percent of respondents and the least likely method for 45 percent of respondents. The most common reasons for choosing mail as the least likely method were: confidentiality issues (31 percent), slow/delays (19 percent), and a concern that the vote would lose its importance (10 percent).

¹⁹ *The Canadian Election Study is a three wave survey of the Canadian electorate. The first survey was conducted during the election campaign period and 3,925 interviews were completed by telephone. The second survey was conducted in the period following the election and 3,163 interviews were completed, also by telephone. The third study was a self-administered mail-back survey; 2,500 questionnaires were sent and approximately 1,850 were returned. The methods of voting questions were asked in the mail-back questionnaire.*

²⁰ *It should be noted that voting by mail is already permitted under Schedule II of the Canada Elections Act (the Special Voting Rules).*

2. Vote by telephone

36 percent of survey respondents indicated a willingness to vote by telephone, with 44 percent of respondents aged 18-24 willing to use this method. Fewer retired persons (18 percent) than others were willing to vote by telephone, and 39 percent of respondents with a disability that affects their mobility or agility were willing to vote by phone, compared to 16 percent with a disability that affects their sight or hearing. Voting by telephone was the most likely method for 26 percent, and the least likely method for 40 percent of respondents. Common reasons for choosing vote by telephone as least likely were: confidentiality (43 percent), risk of fraud (21 percent), and accuracy (9 percent).

3. Vote by personal computer

Overall 29 percent of survey respondents were willing to vote by personal computer. That proportion increases to 43 percent among those aged 18-24. More students are willing to vote by computer (50 percent), compared to working (33 percent), unemployed (31 percent), or retired (10 percent) people and homemakers (22 percent). Only 16 percent of respondents with a disability reported a willingness to vote by computer (all types of disability). Voting by computer was the most likely choice of method for 18 percent of respondents, and the least likely method for 43 percent of respondents. The most common reasons for choosing computer as the least likely method were: problems with access (37 percent), and confidentiality (24 percent).

4. Vote by touch screen computer

54 percent of survey respondents were willing to vote using a touch screen computer. The touch screen method was popular among working people (56 percent willing to use), students (64 percent), unemployed persons (50 percent), and homemakers (51 percent). 30 percent of respondents with a disability that affects their sight or hearing were willing to vote this way, compared to 52 percent with a disability affecting their mobility or agility. Voting by touch screen was the most likely choice of 37 percent of respondents, and the least likely method for 16 percent of respondents. The problems cited most often by those who chose touch screen as least likely method were: a risk of fraud or tampering (15 percent) and confidentiality (22 percent).

5. Vote using a ballot counting machine

Overall, 67 percent of survey respondents report being willing to vote using a counting machine. The highest proportion of willing responses came from respondents aged 65 and over (77 percent). 73 percent of retired persons were willing to vote by this method. 64 percent of respondents with a disability report a willingness to vote using a counting machine. Counting machines were the most likely choice of 52 percent of respondents

and the least likely choice for 16 percent. Inconvenience (32 percent) was the most commonly cited reason for selecting counting machine as the least likely choice.

Based on these results we set out to model the voting process using the telephone, Internet (vote by computer), and electronic kiosk (vote by touch screen). We did not model ballot counting machines as they are more geared toward tabulation and less the actual process of casting a decision, nor did we model voting by mail since it is not a technologically innovative option.

6. Summary of voting preference survey results

Table I: Willingness to use Alternate Methods

Method	mail	phone	computer	touch screen	counting machine
% willing to use	31%	36%	29%	54%	67%

Table II: Most Likely and Least Likely Methods of Voting

Method	mail	phone	computer	touch screen	counting machine
most likely (%)	20	26	18	37	52
least likely (%)	45	40	43	16	16

Table III: Reasons for Choice of Least Likely Voting Methods

	total	mail	phone	computer	touch screen	counting machine
risk of fraud	14	14	21	12	15	6
confidentiality	29	31	43	24	22	8
accuracy	7	6	9	5	8	8
slow/delays	10	19	4	5	6	9
loses importance	5	10	4	3	3	3
access	16	7	9	37	13	11
tech/comp.	2	1	1	5	7	2
inconvenience	7	4	1	2	12	32
other	9.5	9	8	8	12	20
don't know	0.3	0.5	-	0.2	2	0.6

B. Public Policy Forum Roundtables

Elections Canada engaged the Public Policy Forum to convene a series of roundtables with key electoral stakeholder groups—Members of Parliament and Senators, persons representative of voting groups that have a major stake in the use of new technologies for electoral purposes, and selected opinion leaders. These roundtables took place between March and May 1998 and are summarized below.

1. Members of Parliament and Senators

The roundtable discussion with Members of Parliament focused on ways of complementing or enhancing the current voting system with technology. Three areas of concern associated with technological change emerged from the discussions.

1. Technological issues—participants considered Canada’s technological requirements for elections, focusing on the issues of security and suitability.
2. Social issues—some discussion was devoted to the social aspects of technological change particularly the fact that not all segments of the population would be able to experience or benefit from changes to the same degree.
3. Political issues—the political aspects of technological change were debated including the issue of whether or not technological change would alter Canada’s system of representative democracy.

Technological issues

The discussion opened with the question of whether or not technological change would actually benefit or enhance the voting process. While it was recognized that technologies like the telephone and the Internet could help to overcome some of the accessibility problems faced by the disabled, the elderly, and individuals with limited sight or hearing—and possibly help to increase voter participation—it was also recognized that electronic voting attempts in the recent past have met with varying degrees of success, and that public opinions on new technology are varied.

Concerns were also raised that the new technologies might alter the fundamental nature of Canadian politics. Some participants felt that lessening the effort required to cast ballots (deformalizing the process), might prompt voters to take an equally casual view of the issues at stake in the election. Thus, the advantages of using technology to increase voter participation could potentially be offset by unintentional changes in the vote itself.

In addition to the immediate questions of the necessity for change, two main issues emerged during the discussion concerning the implications of adapting new technologies to the election process—security and applicability.

In terms of security, concern was expressed that the integrity of an electronic voting option could be compromised in the event of an elector's password or other personal identifier getting into the wrong person's hands. The recent North York telephone plebiscite was stated as an example where personal identification numbers (PINs) were distributed through the mail and then used by electors to access the telephone voting system. It was argued that individuals might be tempted to intercept these PINs and to corrupt the vote. On a smaller scale, it was suggested that a single voter might coerce members of the household to vote for a particular candidate. Similar security issues were discussed for other technologies like the Internet, and kiosk-voting.

In terms of applicability, there was much discussion as to which technology should be used (the telephone, the Internet, or kiosk) given their differing penetration levels in Canada. The respective advantages and disadvantages of the technologies were discussed.

It was recognized that the telephone has the highest penetration rate among the three technologies, and as such, seems the obvious choice. However, the security issues raised in respect to PINs concerned Parliamentarians, as did the high number of rural telephone customers connected by multiple party lines who would not be able to securely take advantage of this option.

While kiosks, in the form of automated teller machines (ATMs) can be found on almost every street corner, Parliamentarians noted that ATM fraud is still common and that such a system, which like the telephone relies on the activation of a personal identifier, has security issues. Concerns were also raised that an ATM-style system would be difficult to implement in low-density, rural areas.

The idea of personal computer or Internet-based voting was also discussed given the proliferation of these devices. Participants praised the Internet's potential to inform voters of the issues and candidates' platforms; however, they questioned its use as a voting tool given that it is the least secure of the three technologies.

Parliamentarians and Senators were, however, enthusiastic about the possible utilization of various voting technologies to improve accessibility for specific groups within the electorate.

Social issues

Discussion of the technical implications of various technologies led to the identification of a number of social issues which might accompany any technological change. Parliamentarians and Senators noted that technologies rarely affect different segments or age groups of the population in the same ways. The introduction of new technologies inevitably requires some learning on behalf of the users which could negatively impact their ability to take part in the voting process. As a result, participants agreed that care must be taken to prevent new tools from excluding any sector or strata of society.

Political issues

Parliamentarians and Senators engaged in a discussion of the nature of Canadian democracy and the role that technological change could play therein. The principal issue raised was that the Canadian political system is based on representative, not direct democracy, and that the potential for decentralization in an electronic voting system (i.e., one in which voting takes place in remote locations as opposed to the polling station) could potentially blur the lines between the two.

Participants agreed that new technologies like the Internet are excellent means of informing the electorate and incorporating greater numbers of people in policy discussions. However, in terms of increasing accessibility to the voting process through the use of such technology, some participants argued that decreasing voter turnout is more likely due to a lack of engagement in political issues, attitudes toward politicians, and apathy, due to the accessibility to the process.

Voter participation received considerable attention as participants discussed the value of raising voter turnout through enhanced technology. Some members of the group questioned whether or not increased participation implied greater representation. In short, while the use of new technologies could be perceived to be part of the “inevitable march of democracy,” there was concern that introducing new means of voting without understanding one’s objectives for doing so could endanger the system in place.

Conclusions

The participants in the roundtable discussion agreed that there exists a need to establish objectives for enhancing the voting process with new technologies.

A consensus emerged that Elections Canada should arm itself with as much knowledge as possible on the advantages and disadvantages of the new technologies, as well as the different perspectives of Canadians toward the introduction of new means of voting. Parliamentarians and Senators suggested that Elections Canada should make efforts to: track attitudes toward technological enhancement using time series data; keep abreast of technological developments which could improve the voting process; create a database to track innovations and experiments in electronic voting; and remain on the leading edge in its use of new voting technologies. They were also supportive of the idea of pilot testing the new technologies for groups for whom accessibility to voting is a major concern.

2. Representatives of voting groups

Roundtable participants were identified and specifically invited to the session because of their ability to represent the views of various groups within Canadian society. This consultation process provided a preliminary sample of the challenges faced by individuals with low literacy skills, with physical disabilities, with visual and hearing impairments, the elderly, new Canadians and aboriginals. Each representative was asked to assess three potential technologies as they relate to the voting process—the telephone, touch screen kiosks, and the Internet.

Literacy groups expressed their need for a voting process which incorporates “plain language” and which is consistent from year to year. In evaluating the three proposed technologies, literacy groups emphasized that it is not so much an issue of accepting new technology but understanding how it works. Voting by telephone was generally supported as long as the process would be easy to understand and participate in. Kiosks were also popular as they incorporate pictures and use voice activated technology. The use of the Internet was seen as a potentially useful tool as long as individuals were properly educated about, and had access to, the system.

Representatives of persons with disabilities supported the telephone as the most viable option for their stakeholder group. This option allows electors to stay in the comfort of their own homes. Kiosks were seen as useful, but not easily accessible to people with certain disabilities. The Internet was recognized as potentially beneficial, although few stakeholders within this group have access to the Internet.

The most important characteristic of any voting alternative for individuals with visual impairments is the ability to increase their independence and confidence in participating in the electoral process. It was recognized that voting by telephone would be a possibility so long as the process was easy to use and provided enough time to comfortably negotiate the various options and steps throughout the process. Kiosk and Internet technologies were seen as less useful if they relied on reading a screen.

The hearing impaired community expressed substantial concern with the current TTY system (telecommunications devices for the hearing impaired). The most accommodating method of communicating with this group is through one-on-one sign language. Kiosks were largely supported by this group because the interface between the technology and the user does not rely on the spoken word.

While the seniors community in Canada is increasingly embracing Internet technology, in general, many seniors are fearful that technology will take away their access to human services. Numerous individuals within this group are fearful that if they support technology alternatives, the more traditional, and in many cases, preferred service options will be taken away. Voting by telephone was largely supported by representatives of this group as it would facilitate voting for those confined to their homes or nursing home facilities. The only concern expressed about telephone voting was that it not be designed in such a way as to require use of the touch pad. Many seniors have trouble with fine motor skills. This could be ameliorated through the use of integrated voice technology.

Participants representing new Canadians focused on education and awareness issues. Many new Canadians come from different cultures and are not fluent in French or English. Technologies which offered multilingual capabilities would assist this group.

Representatives of the aboriginal community were largely supportive of the possible voting alternatives. It was pointed out that on many reservations, telephone penetration rate is not high, and the potential of the Internet has not yet been realized. Another concern tabled by aboriginal representatives was that of language and communication. High quality translation services are seen as essential.

Conclusions

The participants in the roundtable discussion agreed that the possibility of improving accessibility to the voting process should be further explored. Participants cautioned Elections Canada to proceed in a consultative fashion however and to not limit the voting options available to groups within the electorate. This comment reflected some dissatisfaction among representatives with the introduction and proliferation of technology with a perceived lack of choice in the banking industry.

3. Selected opinion leaders

The roundtable discussion with selected opinion leaders covered all segments of the voting process from registration and vote casting, to validation, collection and tallying of results. In addition, the group discussed issues such as privacy, transparency, accessibility, integrity, universality, accuracy and anonymity. The most salient points

from the discussion of verification of eligibility to vote and the use of technology in the act of casting a decision are summarized below.

Voter identification technologies

This step in the voting process ensures that the individual who is registered to vote is the person who actually casts the vote. Four technologies were put forward by the participants to deal with this challenge: cryptography, voice recognition, biometrics and smart cards.

Cryptography (the recognition of hand writing and signatures) is seen to be a promising technology that is developing very rapidly. Voice recognition was cited as a growing and increasingly popular medium of verification, where current systems can now transact thousands of calls daily within a secure and verifiable environment. Biometric identification is also becoming more practical, and it was noted that Canadians seems to be less concerned with using the face as a biometric identifier than fingerprints because fingerprinting continues to be associated with the criminal system.

While these options were recognized as valid and likely able to meet the needs of the voting system, it was generally agreed that a fourth option—smart cards—may be even better suited to the requirements of Elections Canada. A smart card is a transaction card, such as a health card, that has an embedded electronic chip with the capacity to carry a large amount of data. It would be possible to issue all Canadians with such cards such that the chip would be activated as soon as the individual reached eligible voting age. Smart cards could be integrated with kiosks or more advanced telephones that have card swipe technology. The general preference of the participants was towards use of smart cards with telephones since they are readily accepted and accessible to society and would be less costly to implement than individual kiosks across the country.

Policy issues

The policy issues associated with the introduction of many of the alternatives were seen as considerably more challenging than technological feasibility.

While linking federal and provincial databases to produce a more accurate voter registration list may be beneficial to Elections Canada, the broader societal reaction to this process could be very negative. To what degree do Canadians want their movements tracked and recorded by governments? Smart cards are also a technologically superior product, but they may be

viewed by individuals as intrusive and a threat to privacy. Citizens may view technology as being too smart—potentially threatening the anonymity of the voting process.

Participants recognized that there will be trade-offs between certain attributes of the voting system. Focusing on the accuracy and integrity of the registration lists may in fact create more barriers as the system becomes more complicated and potentially more intrusive to the users. Introducing new technologies that create greater verifiability within the system may threaten anonymity. Participants recommended that Elections Canada be clear about the specific aspect of the voting system that is intended to be addressed by introducing new technologies. If accessibility is the key issue, then there must be a recognition of the impact that voting alternatives will have on the other attributes of the election process.

Conclusions

Drawing from the experiences of the participants in introducing new, technologically advanced alternatives to various clients and stakeholders, it was agreed that a hybrid approach would be beneficial. Different services meet the needs of different people and Canadians want to have a range of choices in accessing services. The objective should be to maintain the current level of service to the public, and use new technologies to build multiple channels to access the voting system.

VII.

Modeling the Voting Technologies

In this section we present narrative summaries of the current voting process and how that process would unfold if voting were to take place using telephone, Internet, or electronic kiosk. Canada's election law is highly detailed so we have endeavored here to present the most important aspects of the process. These models are meant to be illustrative of voting technology possibilities. Other options are possible.

As noted earlier, the issue of effectively identifying eligible voters (e.g., PIN numbers, fingerprints, voice prints, retina scans) is the greatest hurdle for the voting technology options.

Technology experts agree that there are several possible solutions to the personal identification issue; such as, electronic signatures, voice prints, fingerprinting, retina scanning, and smart cards. However, each of these solutions has a cost and raises a number of privacy issues.

Cost problems are likely to be overcome over the medium term as a result of technological advances and falling technology prices. Issues related to privacy are more challenging and will require on-going assessment of Canadians' willingness to use such personal identification devices.

A. Current voting process

We began our modeling efforts by gaining a thorough understanding of the current voting process. By current voting process, we mean that process which the majority of Canadian electors use—voting in person, at the polling station without assistance. It should be noted that there are several variations of this process including special ballots (international, national, local, acute care, incarcerated, and armed forces), advanced and mobile polls, and casting votes with assistance (assistance of a family member, assistance of a friend, or assistance of the DRO and poll clerk).

The following models are presented in seven key process steps. These are: (1) registration confirmation; (2) the ballot; (3) casting a decision; (4) ballot verification and anonymity of the elector; (5) submission of the ballot; (6) vote tabulation²¹ and (7) retention and storage. This modeling is not meant to exhaustively capture the voting process but rather to highlight the key process steps and how the use of technology in these steps would alter the conduct of the current voting process.

1. Registration confirmation

An elector, before receiving a ballot paper from the deputy returning officer (DRO) must give his or her name and address to the DRO and polling clerk and, on request, to an agent of a candidate. Once the elector's eligibility to vote is confirmed the elector's name is crossed off the registered voters list.

2. Ballot

Following registration confirmation, the DRO prepares a ballot for the elector. The DRO initials the ballot, tears the ballot from the ballot book, folds the ballot into three sections, and presents the ballot to the elector.

The DRO instructs each elector on how and where to affix his or her mark on the ballot, shows the elector how to fold and unfold the ballot, and instructs the elector to return the ballot once they have completed making his or her decision.

The elector then proceeds to the private voting area behind a cardboard screen.

3. Casting of decision

The elector unfolds the ballot and marks his or her choice using a pen or pencil in the circular space provided on the ballot opposite the name of the candidate of his or her choice. Should the elector make an error in his or her selection or inadvertently deface the ballot paper, the elector returns the ballot paper to the DRO and is issued a new ballot paper. Each elector is allowed one replacement ballot paper.

4. Ballot verification and anonymity of the elector

The elector then refolds the ballot and returns it to the DRO. The DRO, on receiving the ballot from the elector, without unfolding the ballot, verifies that the ballot is the same one that was handed to the elector by examining the initials and serial number on the back

²¹ While vote tabulation is outside of the mandate of this project, it is included in the models to demonstrate the impact that various voting technology options have on the tabulation process.

of the ballot thus ensuring that the ballot cast is the one which was handed to the elector by the DRO.

The DRO then removes and destroys the serial number on the ballot in full view of the elector and all other persons present thus separating the identity of the elector from the ballot.

5. Ballot submission

The DRO then returns the ballot to the elector who puts it in the ballot box. If the elector requests it, the DRO shall deposit the ballot in the ballot box. As soon as the elector's ballot paper has been deposited in the ballot box that elector has voted and the poll clerk so indicates opposite the elector's name on the register list.

6. Vote tabulation

Immediately after the close of the poll, in the presence and in full view of the poll clerk and all other persons present (e.g., candidates and his or her agents), the DRO: counts the number of electors who have voted; counts the spoiled ballot papers; counts the unused ballot papers; and checks the number of ballot papers supplied by the returning officer against the number of spoiled ballot papers, the number of unused ballot papers and the number of electors listed as having voted. The number of ballots supplied must equal the total number counted at this point before proceeding.

The DRO then opens the ballot box and empties its contents on a table and counts the number of votes given to each candidate on provided tally sheets.

If in the course of counting the votes a ballot paper is found with the serial number still attached, the DRO will, while shielding that number from other witnesses protecting the identity of the elector, remove and destroy the serial number. The vote is then counted.

In addition, if, in the course of counting votes, the DRO comes across a ballot which does not bear his initials he shall affix his initials in the presence of the witnesses and count the vote if he is satisfied that the ballot paper was supplied to him, an omission has been made, and all ballot papers are accounted for.

All ballot papers that are not rejected by the DRO are counted and a list kept of the number of votes given each candidate.

Once this is completed, the DRO prepares a statement of the poll.

7. Retention and storage

Envelopes, containing the unused, rejected or spoiled ballot papers, those counted for each candidate, the official list of electors, and other documents used at the poll, are placed in the ballot box and sealed with seals prescribed by the Chief Electoral Officer and transmitted to the returning officer.

B. Vote by telephone

The use of many technology voting options require the user (voter) to have in his or her possession, some unique identifier recognizable by the voting system. A personal identification number (PIN) similar to that issued by financial institutions for the use of debit or credit cards has been used by some past leadership contests. In these cases, the PINs were generated by an approved third party under the supervision of a national audit firm. The PIN generation process itself can be designed such that integrity and confidentiality can be assured.

PINs can then be assigned to registered voters on a random basis and provided in secure transmittal vehicles (mail envelopes). Once again, there are well established PIN print and mail routines generally accepted and used by all major financial institutions and others. The delivery of PINs is still reported periodically as a problem as there is limited control over the mail delivery system. Multi-residential complexes have reported mail loss.

Use of the telephone as a means of increasing accessibility to the voting process is an attractive option for a number of reasons including the near universal presence of telephones in Canadian households, electors' familiarity with the device and how it works, and the fact that an elector would not need to attend the polling station to vote. For these reasons, telephone voting is the most viable of the three voting options we assessed.

The main challenges to telephone voting include system limitations, providing access for physically disabled electors, electors whose language is not English or French, electors with rotary dial telephones who could not take advantage of this option, and the issuance of personal identification numbers (PINs) to electors so that they can access telephone voting.

In terms of systems limitations (which limit the volume of calls at any given time), Canadian telephone companies are updating their telephone switches across the country from analog to digital. Digital switches have much greater capacity and are better suited to handle the volume of calls associated with elections.

Advances in integrated voice technology have made it possible for electors to speak when voting instead of using a touch tone pad to cast their decision. This makes telephone voting an option for those with rotary dial telephones and those who lack the manual dexterity which would be necessary when using a touch tone pad. In addition, integrated voice technology offers multi-lingual capabilities so that voters could complete the voting process in languages other than French or English.

The issuance and subsequent assurance that the “right person has the right PIN” remains telephone voting’s most significant challenge. As we will demonstrate below, the telephone voting process begins with an elector telephoning the voting number and inputting a PIN to confirm his or her eligibility to vote. The question remains as to how one securely provides that PIN to the elector and how one ensures that once the elector has the PIN the elector continues to hold his or her PIN and only that PIN and that when voting from a remote location that elector is able to vote without any outside influences. In essence, the two main issues are: first, ensuring that the elector does not treat their PIN as a marketable commodity to be sold for money or favour; and second, that when voting from a remote location, the elector can make their choice free of coercion. Legislators in the State of Arizona recently voted against any use of the telephone in state elections until these issues could be resolved. While there are a number of options for solving this issue such as electors being prompted upon voting to provide an additional piece of personal information such as mother’s maiden name or the numeric digits in their postal code to verify the elector’s identity, such measures are still open to voting fraud and coercion. A second option is registering to vote by telephone so that a “voice print” can be taken for eligibility verification later. However, this option would be costly and require the storage of a sizable amount of information.

C. Vote by kiosk (touch screen computer)

The experts we interviewed regarded this option as technologically viable given the maturity of the technology and the availability of public networks (such as the Interac network of banking machines or the HRDC network) which could be used for voting purposes. While the use of publicly available networks is attractive from a cost-effectiveness perspective, it opens up a host of issues associated with security and secrecy. As a result, we focused our efforts on assessing terminals which could be placed in polling stations and portable terminals which could be used in acute care and mobile settings.

D. Vote by Internet

We discovered that Internet-based voting is the least viable of the three technologies reviewed because of shortcomings in both accessibility and security.

Despite the dramatic increase in the number of Canadians who are “on the net,” the total number of citizens with access to the Internet is still small. Because the Internet has not penetrated the Canadian household in numbers anywhere close to the telephone, this voting option would only be available to a small number of electors unless computers were provided in polling stations or other public buildings such as libraries.

Security concerns associated with Internet-based voting relate to the link between the elector’s computer and the Internet service provider. Once the two computers are linked there is an increased possibility that computer “hackers” could access and manipulate election results. While the experts we spoke to were confident that security issues were surmountable, they suggested that it would take another two or three years to provide a level of security which was acceptable for voting. In addition, Internet-based voting would make it necessary for Elections Canada or a sub-contractor to stay one step ahead of those who may attempt to manipulate its network adding extra expense to managing an event.

E. Electronic voting model

Given the similarities in various process steps across the technologies, we have provided one model below which highlights differences in the technologies as appropriate.

1. Registration confirmation

Telephone

At this step, the elector would dial in to an automated telephone voting service. After prompting the elector to input or verbally identify his or her language of choice, the system would then prompt the elector to either input on the touch tone pad or speak his or her PIN. Technology has been used to detect attempts of fraudulent access to telephone voting systems. When a predetermined number of calls and attempts to input an incorrect PIN is detected the system would terminate the call. For those electors who may be having difficulty inputting or speaking their PIN, the system could be designed to allow them to press “0” or stay on the line for assistance through a designated back-up call centre.

The PIN would be used to confirm eligibility to vote. Because electors could vote from across the country or around the world the PIN would have to have a defined life to facilitate the closing of traditional polls and the tabulation of votes.

Once the elector has been confirmed as eligible to vote, his or her name would be so marked in a database which would be on-line with traditional polling stations and other electronic options available to electors such that an elector could not vote twice. This would require the real time, on-line automation of the register of electors at the polls across traditional and electronic voting options.

In the case of a number of electors calling in at the same time, calls could be placed in queue. Callers whose call was received before poll closing but who could not access the system until after closing would remain eligible to vote so long as their PIN was valid.

Electors would then listen to a message verifying the electoral district in which they were eligible to vote and asked to respond either verbally or by pressing one of the touch tone keys that this information is in fact correct. Should the information be incorrect the voter would have the option of pressing a defined key or staying on the line for assistance.

Kiosk

At this step, the elector would access the automated kiosk. The kiosk could be fully automated handling all voting processes from registration confirmation through tabulation and then send the results to a central repository. With this option the kiosk could be located in a polling station or in unattended public locations. Alternatively, the kiosks could be located within polling stations with certain functions such as registration and tabulation handled by polling station staff. In addition, staff could operate mobile kiosks for use in places such as acute care centres.

After prompting the elector for his or her language of choice, in the unattended situation, electors would either insert a form of “smart card” to set the voting process in motion and then be prompted for a PIN. Alternatively, the kiosk could be designed to commence with the PIN prompt. Technology has been used to detect attempts of fraudulent access to computer systems. When a predetermined number of attempts to input an incorrect PIN is detected the system would terminate access to the site.

The PIN would be used to confirm eligibility to vote. Because electors could vote from across the country or around the world the PIN would have to have a defined life to facilitate the closing of traditional polls and the tabulation of votes.

Once the elector has been confirmed as eligible to vote, his or her name would be so marked in a database which would be on-line with traditional polling stations and other electronic options available to electors such that an elector could not vote twice. This would require the real time, on-line automation of the register of electors at the polls across traditional and electronic voting options. This would be technically-difficult should a remote or portable kiosk-type of device be employed.

Electors would then receive a message identifying the electoral district in which they were eligible to vote and asked to respond by pressing a defined key on the keypad or by using a light pen or their finger on a defined area of the screen. Should the information be incorrect the voter would have the option of pressing a defined key to make necessary corrections.

Internet

At this step, the elector would access the automated voting Web site through a personal computer. After prompting the elector to input his or her language of choice, the system would then prompt the elector to input his or her PIN. Technology has been used to detect attempts of fraudulent access to computer systems. When a predetermined number of attempts to input an incorrect PIN is detected the system would terminate access to the site. For those electors who may be having difficulty inputting or speaking their PIN, the system could be designed to allow them to access a help function either on-line or by calling a telephone help line.

The PIN would be used to confirm eligibility to vote. Because electors could vote from across the country or around the world the PIN would have to have a defined life to facilitate the closing of traditional polls and the tabulation of votes.

Once the elector has been confirmed as eligible to vote, his or her name would be so marked in a database which would be on-line with traditional polling stations and other electronic options available to electors such that an elector could not vote twice. This would require the real time, on-line automation of the register of electors across traditional and electronic voting options.

To ensure greater accessibility to this voting option, Web site access could be provided through public buildings such as libraries or Government of Canada buildings.

Electors would then receive a message identifying the electoral district in which they were eligible to vote and asked to respond by clicking on an “OK” button to verify that this information is in fact correct. Should the information be incorrect the voter would have the option of pressing a defined key to make necessary corrections.

2. Ballot options

Telephone

There are a number of ballot options available. For example, electors could listen to a listing of candidates and their respective selection codes, or electors could be prompted to enter the selection code of their candidate of choice from a paper ballot or other information provided to them in advance of election day.

Kiosk and Internet

As with the telephone, there are a number of ballot options available. For example, electors could be prompted to enter the selection code of their candidate of choice from a paper ballot provided to them in advance of election day, view a list of candidates and their respective selection codes or view a combination of written text and pictures for each candidate.

3. Casting of decision

Telephone

In casting a decision, electors would be prompted to enter the selection code for the candidate of their choice, or in the case of integrated voice technology verbally select the candidate of their choice by responding to “yes” or “no” prompts from the system or by speaking the selection number of the candidate of their choice. The “yes” or “no” option is simpler to administer.

The system would then answer back the elector’s choice and ask for either verbal or key pad verification. The elector would also have an opportunity to cancel the selection they had made. The system could be designed to provide the elector with one or more opportunities.

Limitations could be placed on the system to confine the number of attempts an elector would receive at inputting their selection to prevent delays within the system.

Consideration could also be given to extending the voting period similar to the special ballot process to manage volume issues.

Kiosk

Electors would then make their selection by either inputting their chosen candidates selection code on a numerical key pad, or by clicking on their candidate's name, party or picture using a light pen or their finger.

The system would then portray the elector's choice and ask the elector to verify his or her selection using a defined keyboard key or by the light pen or his or her finger. The elector would also have an opportunity at this stage of canceling the selection they had made. The system could be designed to provide the elector with one or more opportunities.

Limitations could be placed on the system to confine the number of attempts an elector would receive at inputting his or her selection to prevent hold ups within the system.

Internet

Electors would then make their selection by either inputting their chosen candidates selection code or by clicking on their candidate's name, party or picture using the keyboard (e.g., arrow and enter keys) or mouse.

The system would then portray the elector's choice and ask the elector to verify their selection using a defined keyboard key or by using the mouse. The elector would also have an opportunity at this stage of canceling the selection they had made. The system could be designed to provide the elector with one or more opportunities.

Limitations could be placed on the system to confine the number of attempts an elector would receive at inputting his or her selection to prevent hold ups within the system.

Consideration could also be given to extending the voting period similar to the special ballot process to manage volume issues.

4. Ballot verification and anonymity of the elector

Once the elector has confirmed his or her selection the ballot would be considered verified and collected by the system. The system would separate the voter's PIN from the ballot at this step.

5. Ballot submission

The ballot would then be stored for tabulation, the PIN canceled, and the voter marked as having voted. As mentioned above, Elections Canada would require "real time" voted status of electors so that electors could not vote twice by attempting to vote at a polling station or through any other option.

6. Tabulation of votes

The system would communicate votes on-line to a central tabulation area where the votes would be counted and redistributed to the appropriate electoral district and polling stations where the returning officers would add the totals to the polling station figures.

7. Retention and storage

Transcripts of recorded votes could be stored either electronically (e.g., diskette format), on paper or both.

F. Conclusions

Our review of the technology reasonably available to support the elements of the voting process concludes that:

- All three of the new voting technologies (telephone, kiosk and Internet) are sufficiently evolved to support testing in a fully functional pilot.
- None of the technologies examined or options available in the near future present a universal solution. It is our view that in addition to the present manual vote, vote processes consisting of a combination of telephone, kiosk/terminal and Internet should be considered for future elections.
- Of the technologies currently available, the kiosk/terminal located in a controlled area presents the highest level of potential security balanced with the least risk. We base this on the observation that reasonably functional devices have been developed and could be readily deployed on a test basis in a

controlled manner. However, we believe that the cost of deploying this technology will result in only selected and limited use in Canada.

- The telephone based option offers the potential for the most significant impact on the largest base of Canadian voters. The telephone is clearly the most accepted and widely available of the relevant technologies. Access issues are largely manageable with careful planning and continuing enhancements to the Canadian telephone infrastructure, which is also readily accessible from outside of the country. Further enhancements to the commercialized use of the telephone infrastructure through interactive data phones such as the Northern Telecom interactive Vista 350 can provide full “kiosk/terminal” functionality to individual households. Finally, recent significant advancements to the commercial use of voice recognition and command systems can lead to the full elimination of the need for telephone key pad interaction, thus further simplifying the use of this technology for Canadians. The Toronto Dominion Bank among others, is one example of a Canadian organization that has announced the introduction of the “Green Line TalkBroker”, a market information service responding to spoken word commands. This is similar to the Charles Schwab system implemented in the USA which currently responds to over 350,000 calls daily.

VIII.

Implications of the New Technologies for Electoral Administration

A. Effect on criteria for effective electoral administration

Our analysis shows that adoption of the new electronic technologies in the electoral process can have a generally positive impact on the seventeen criteria for electoral administration presented in Section III. Fundamental to support for technology-based voting is the presence and functionality of a relational database. This database would hold information on registered voters, their electoral districts and the candidates. Elections Canada currently maintains the foundation for this data base in the National Register of Electors.

Our approach to assessing the organizational and administrative impacts involved interviews with Elections Canada officials to gain an understanding of the issues which we then presented to technology experts for their views.

1. Democracy—one eligible voter can cast one vote

If any of the various voting options were offered on election day, Elections Canada would require an on-line, real time database of information across the options to ensure that no person voted more than once. Alternatively, if different options were provided on different days (e.g., advance poll), this would remove the necessity for real time information.

2. Accuracy—the final vote count is reflective of the intent of voters

Technology options can provide electors with the opportunity to confirm that their vote is recorded as they intended. Electors can change or cancel their recorded vote prior to it being cast.

3. Security—measures in place to protect the integrity of the process

Technology-based security controls are mature and widely used in many industries. Security controls are also an area where there is continuing active advancement to support emerging applications of technology.

Use of unique Personal Identification Numbers:

- will link to an elector (and therefore, electoral district);
- will be canceled upon casting of a vote; and
- will deny access to system after a specified number of attempts with an incorrect PIN.

Telephone voting access from a particular telephone number can be blocked if the security system detects a specified number of attempts to vote with non-valid PIN.

Connection to the voting system by Internet or telephone can be disrupted at the end of a specified time period to prevent blocking of lines to electors.

Firewall protection of the database will be a dynamic issue to be addressed and updated periodically.

4. Secrecy—no vote can be traced to the voter

The act of casting a vote can be linked to an elector in order to mark the elector as having voted. After confirming and casting the vote, it will be “detached” from the elector and placed for tabulation with no retraceable path.

5. Verifiability/auditability—the vote results can be verified after the count

Voting results can be recorded electronically. These can be re-accessed electronically or presented as transcripts. Counts of electors and any spoiled or incomplete ballots can be compiled during the poll.

6. Privacy/confidentiality—information collected on electors is used for elections purposes only

Use of and access to stored data must be covered by legislation.

7. Transparency—process is open to outside scrutiny

Agents of candidates can view updates of electors who have voted using new technology such as computer screens or printouts.

8. Accessibility—the specific needs of eligible electors are taken into account so that none are disenfranchised

Use of technology can expand access to numerous groups of electors who have transportation, mobility or availability of time issues. It would probably be several years however, before a technology based voting option could be selected to support 100 percent of the electorate.

9. Neutrality—electoral processes do not favour one candidate or party over another

Adoption of technology options would be for the convenience of the electors not the candidates.

An exploration of technology options does offer the opportunity to present candidates for selection with such additions as party colours or candidate photographs. Adoption of such opportunities may support the multi-lingual requirements.

10. Simplicity—the voting processes do not make voting unduly complicated

A large proportion of the electorate is familiar with the use of many technologies; such as, banking terminals, automated phone services for such tasks as stopping or starting newspaper delivery, voice mail, remote control access devices for televisions, security access, credit and debit cards. Administration of the electoral system will be simplified through automation of many tasks.

11. Flexibility—the voting process can handle a variety of ballot styles and counting formats

The use of technology provides sufficient flexibility to allow for different options for voting as well as different ballot styles and counting formats (e.g., telephone voting, voting using a touch screen kiosk, voting by computer).

12. Scalability—the voting process can be scaled to handle large and small electoral events

Hardware capacity and speed is increasing exponentially and indications are it will continue to do so. Current technology will support a database large enough to support a federal election.

13. Recoverability—the voting process provides for duplication of systems to prevent data loss

Storage technologies will retain data in a compressed format; therefore, storage of duplicate data does not require a doubling of storage capacity. Transcripts of data can be prepared and stored.

14. Mobility—the voting process allows votes to be cast from locations other than the traditional polling station

The use of technology based voting options can eliminate the need for an elector to attend a polling station. Electors could cast their votes from any site where telephone or Internet access is available. This could permit Canadians to vote from overseas locations.

15. Speed of count—results can be reported quickly

The count of the cast votes could be ongoing at a national or site basis. Transmission of site counts could be periodic or at the close of polls. Compilation of transmitted results on the central data base could provide results in minutes.

16. Cost effectiveness—the voting process is effective and economical

Adoption of technology can decrease the time involved in the heavily manual electoral administration processes. Use of the telephone or Internet for electoral process relies on technology available to the electorate. Elections Canada could provide the infrastructure to support the process. The planned use of acquired technology, in addition to federal elections, should be a factor in determining the cost effectiveness of the acquisition. Options for multiple use of the technologies should be investigated and considered.

17. Technical durability—the voting process allows the basic electoral infrastructure to be reasonably insulated from obsolescence

Elections Canada would have to carefully evaluate the acquisition of supporting technologies in an effort to determine what will be most viable for the future. Periodic migration to emerging database technologies should be anticipated. Keeping the database current with system versions will help ensure the data integrity. Acquisition and maintenance of specialized end use terminals must be carefully considered if these may not be used for another four years. This does present an opportunity for partnerships with provincial and municipal electoral bodies.

B. Legal considerations

In our work on this project we developed a list showing the sections of the *Canada Elections Act* that would have to be amended to allow for electronic voting (please see Appendix B). On reflection, we have concluded that amendments to the *Act* as listed would serve to complicate an already difficult and complicated piece of legislation. In fact, the *Act* is so intrinsically linked to the current process that changes would need to be sweeping and widespread. The better course, if Parliament were considering amendments to allow for the possibility of electronic voting, would be to write a new schedule of the *Act* to permit electronic voting for whatever purposes, and under whatever terms and conditions, Parliament deemed appropriate. This was the course followed in the case of special voting rules.

C. Costs

It is a “law” of information technology that as the power and efficiency of computing systems increases, costs drop, often dramatically. Thus, the degree to which cost is a factor in the potential application of the new technologies to the voting process (and it is in almost all cases) changes with every passing month. And if experience is any guide, what might appear an impossible costly solution to a problem today (in the area of security or privacy) is likely to be resolved cheaply within only a couple of years. So cost is a factor, but it is a relative factor, and one that is constantly changing. The key point is that technology as it applies to voting is becoming cheaper, not more expensive.

A second important consideration, and one that helps to keep the entire issue of technology and voting in proper context, is that the different voting technologies are each relevant to meeting the accessibility needs of different groups in the Canadian population. A particular technological solution for voting by persons with disabilities might appear expensive until one realizes that current measures to ensure accessibility can also be very costly. An average cost-per-electors at the federal level of, \$1.50²² for the conduct of a federal election may include costs of ten times that for members of specific groups where accessibility is already an issue. Technological solutions aimed at the same group should be assessed in that context.

D. Opportunities for partnering

One question which must be answered is whether or not an investment at the federal level in new voting technologies could be recouped through cooperation with other jurisdictions in Canada or abroad. While it would be presumptuous to think of recovering significant portions of the federal cost, it would also be only reasonable to think that some provincial, municipal or foreign jurisdictions would be prepared to share some development costs, or (in Canada) to share the operation of data bases or other infrastructure. This is already the case with some aspects of the National Register of Electors .Furthermore, such cooperation within Canada would reflect and reinforce the

²² The cost per elector of polling activities for the 1993 and 1997 General Elections was \$1.45 (adjusted for inflation 1997 dollars) and \$1.54 (estimated) respectively. These cost estimates are comprised of fees and payments made to deputy returning officers, poll clerks, central poll supervisors, information officers, landlords (rental of polling stations) and printers (printing of ballots) for advance, mobile and ordinary polls. Also included are cost estimates for the stock required at polling stations (e.g., ballot paper, guides/instruction manuals, forms, signs, voting compartments, ballot boxes and stationary). All other costs related to the preparation and delivery of an election are excluded (e.g., elector registration, Special Voting Rules, and candidates and party reimbursements).

notion of the “single taxpayer” and provide value-for-money in the use of tax dollars for the purposes of conducting federal, provincial and local elections.

Beyond the issue of cost, there already have been significant benefits to Canada from leadership and partnering in electoral administration. These benefits would be amplified in areas such as electronic voting where leadership in technology and related administration could pay off in everything from influence at the governmental level to broader business development.

IX.

Conclusions

The integrity of the electoral process—the process of casting and tabulating votes in an election—is one of the cornerstones of our democracy. It is because Parliament attaches such importance to the integrity of the process that it has placed responsibility for the administration of electoral events in the hands of an independent officer of Parliament, the Chief Electoral Officer. And it is because Canadians are concerned to ensure the integrity of the process that they always have been cautious about modifying it.

As we note in this report, the process of actually casting a ballot is one of the features of Canadian life that, on the surface at least, has changed remarkably little over the past 100 years. An overwhelming majority of Canadians who vote in federal elections still do so by physically presenting themselves at a polling station in a church or school and declaring that they are who they claim to be. After having their names crossed off a voters' list, they take a paper ballot and retire to mark it in secret, thereafter returning it to the Deputy Returning Officer, who verifies, by viewing his/her initials on the exterior of the ballot, that the ballot is the same as the one given to the elector. Subsequently, the elector places the ballot in the ballot box.

Yet as we know, behind this traditional scenario lies a host of technological and other changes to the actual administration of elections that have been introduced, particularly in recent years, with relatively little fanfare. The most prominent of these changes are the extension of the Special Voting Rules to all Canadians, the automated National Register of Electors which provides a permanent, updateable voters' list, the Event Management System operated by the Office of the Chief Electoral Officer, and the availability of real time election results on the Elections Canada web site on election night.

These changes, and many others internal to the operations of Elections Canada, have essentially two purposes—to make voting more *accessible* to Canadians, and to make the conduct of elections more *efficient*. Both objectives are seen by Parliament and by Canadians generally as supportive of a vigorous and healthy democracy.

As the revolution in information technology touches more and more aspects of modern life, people in many jurisdictions, both in Canada and around the world, are looking for ways to apply the new electronic technologies in support of these two objectives. The list of countries and other political entities that have expressed interest in the new voting

technologies is long—it includes Canadian provinces and American states, as well as democracies in Europe and in the developing world. These jurisdictions vary significantly in the size of their voting population and their general state of technological sophistication. But all seem to recognize that the new voting technologies offer the prospect of enabling citizens to vote more easily and in a way that preserves the overall integrity of the electoral process.

Preserving the integrity of the process means satisfying both the electorate and their elected representatives that the voting process will meet at least the first ten criteria of effective electoral administration that are listed in Section III, and preferably all seventeen. Together, those conditions represent a high standard of systemic integrity. But it would be easy to set the bar too high—to make it impossible to change the voting procedure on the grounds that any innovation can, in theory, be corrupted; that no new process is perfectly secure; that any process which allows citizens to vote “at a distance” opens the possibility of fraud.

These concerns, however well-intended, can obscure a proper understanding of what underpins the integrity of the *current* process. In a word, our current electoral process is a complex of law, procedures, practices and dedicated administration—not just by the CEO and his staff but by the many thousands of Canadians who are involved in the conduct of every election. Significantly, it is also a matter of what Canadians are prepared to accept as a reasonable standard of security and integrity. They take it for granted, for example, that a cardboard polling “booth” is private because they are confident that no one is watching from a distance with a telephoto lens; they trust the voters’ list and the presence of scrutineers to prevent voter fraud through false declarations of identity or eligibility; they trust the physical process of ballot-counting. They trust our present systems and procedures—what could be called our present “technologies”—because they are used to them. Those procedures work and people accept that they will produce an honest result.

Similarly, the attitude of Canadians to the new technologies is changing as those technologies become ever more present in their lives, whether in the form of banking machines, or scanning devices at the checkout counter, or Internet commerce. People see that these technologies work. They develop a reasonable degree of trust in them, a trust that is not shaken by the fact that any of these systems can be compromised.

To take one obvious example—if Canadians had been obliged to move overnight to the use of banking machines, they would have objected vociferously. As it turns out, the machines were introduced gradually as adjuncts to traditional branch banking. Canadians gradually have come to accept and appreciate the presence of these machines as a way of increasing their access to banking services and keeping costs down.

Similar considerations apply in the case of electronic voting. If the proposal were to move to an entirely new method of voting, using whatever form of new technology, one could

expect a similarly high degree of concern from Canadians. And rightly so. No new method can be “proven” to work without extensive trials; more importantly, no new method can be accepted without exposure over a long period.

Next Steps

With these considerations in mind, Parliamentarians may wish to test and explore ways of using the new technologies to make the act of voting itself more accessible to Canadians. This exploration can be undertaken in several ways.

First, Parliament could make the necessary legislative changes to allow Elections Canada to test some of the promising technologies in controlled, pilot situations where electoral administrators can learn from experience, where Canadians can observe the new methods in action, and where Parliamentarians themselves can draw lessons about the directions in which they wish to proceed and at what pace. One simple way to do this would be for Elections Canada to commission the building of a “pilot” system, using a particular technology, so that Parliamentarians, and Canadians generally, could observe how it worked in a controlled environment.

Second, Elections Canada can continue a dialogue on these issues with interested Canadians, including those with a professional interest in elections, those who supply technology, and those who speak for different sectors of our society for whom technology offers particular benefits in terms of accessibility to voting.

Third, work may be done in educating the public at large on the benefits of the new technologies and their application to the electoral process. Only if the public is fully informed will it be prepared to support changes to something as important as the process of voting in a federal election.

Fourth, there would be merit in Elections Canada continuing to monitor technological developments in this area, and perhaps to fund appropriate research in electoral technologies and their application to voting processes in Canada and abroad. Elections Canada is Canada’s “centre of excellence” in these matters; it should continue to invest in its knowledge base and expertise on technology and the voting process so that Parliamentarians have the benefit of up-to-date information and advice.

The voting procedure and system is not something that should lightly be changed. But nor is it something that a society can afford to ignore—it is too important to our sense of democracy and indeed to our sense of community. To the degree to which the new voting technologies allow Canadians greater access to the democratic franchise, those new technologies deserve to be carefully considered as tools for strengthening electoral democracy as Canada moves into the 21st century.

Appendix A

Project Mandate and Study Team

1. Our mandate

Under contract to Elections Canada (contract #05005-97-1001) KPMG and Sussex Circle's mandate was to identify the forces and factors that have changed, or threaten to change, the environment in which elections are conducted in Canada, notably:

- changes in the attitudes, perceptions and voting habits of Canadians; and,
- the effects of information and communications technology, and the opportunities offered therein to enhance Canadians' accessibility to the voting process.

Two factors in particular help define the strategic context for this study.

- The Chief Electoral Officer (CEO) has been sharing information, data and experience with provincial governments and other jurisdictions, with a view to reducing costs and enhancing the capacity of all partners to fulfill their respective mandates. This trend is likely to continue and represents an opportunity for the CEO to play leading roles both in Canada and abroad.
- While new information and communications technologies are beginning to change how elections are conducted in Canada, the full possibilities and implications of "electronic democracy" have only begun to be explored. This is an area where the CEO is uniquely positioned and qualified to provide advice to Parliament.

In his February 1994 report after the 35th General Election, the CEO suggested Parliament may wish to undertake a careful review of the implications of the new technologies for electoral democracy in Canada. And in his 1994 Strategic Plan, the CEO identified the emerging trends and challenges facing the Office. In addition in 1997, following the 36th General Election the CEO reported on electoral system innovations to Parliament particularly the Register of Electors, and the CEO undertook a preliminary study of

electronic democracy representing the Office's first step in exploring the use of technologies to facilitate the voting process in Canada at the federal level.

It is the responsibility of the CEO to advise Parliament on what he and his Office should be doing, to fulfill this mandate in the most efficient and effective fashion.

The chief benefit of our study, therefore, will lie in its articulating a clear, well-grounded vision of how technology can be used to enhance the voting process in Canada, and a rigorous analysis of the issues and options that will face Parliament and the Canadian electorate with respect to the voting process into the 21st century.

2. Study team

Ian Clark is a Partner in the KPMG Centre for Government. A former Rhodes Scholar, scientific researcher and policy analyst, Mr. Clark's 24 years of experience in the federal government and International Monetary Fund have made him one of Canada's experienced implementers of, and commentators on, changing management and decision-making practices in the public sector. Mr. Clark most recently represented Canada, Ireland and ten Caribbean countries as an Executive Director at the IMF. Prior to that he was Secretary of the Treasury Board and Comptroller-General of Canada.

Rainer Beltzner is a Senior Partner in the Strategic Technologies Group of KPMG. Mr. Beltzner is a recognized expert with 25 years experience in the fields of business system and technology evaluation, strategic planning for technology driven business systems, information systems security, business process re-engineering, project management and system certification. Mr. Beltzner is a graduate of Acadia University. Mr. Beltzner is qualified as a Chartered Accountant and a Certified Information Systems Auditor.

James R. Mitchell is a founding partner of Sussex Circle, an Ottawa consulting firm that provides strategic advice on policy and organization to government and the private sector, both in Canada and internationally. Mr. Mitchell is a former Assistant Secretary to the Cabinet (Machinery of Government), in which capacity he was responsible for providing advice to successive Secretaries to the Cabinet and Prime Ministers on matters related to the organization of government, the reform and renewal of the Public Service and a host of other issues related to governance and change in Canada. He was a principal advisor on the 1993 reorganizations of the federal government. Mr. Mitchell holds a Ph.D. in philosophy from the University of Colorado.

Kathleen Barret is a Manager in KPMG's Strategic Technologies Group and has extensive experience in Information Technology consulting, specifically in the assessment of data centres and voice and data communications environments and call

centres, designing network charge back systems, evaluating outsourcing alternatives, defining metrics for cost performance measurements and evaluating vendor strengths and weaknesses. She has also headed up a number of research initiatives, focusing on the voice and data communications markets in Canada. Ms. Barret holds a degree from Georgetown University's School of Foreign Service.

Alec Taylor is a Senior Consultant in the KPMG Centre for Government. Mr. Taylor is a former member of the federal government's Management Trainee Program with experience at Treasury Board Secretariat, CIDA, and Public Works and Government Services. Mr. Taylor holds a masters degree in public administration and public policy from the London School of Economics.

Appendix B

Voting Technologies and the Canada Elections Act

In the following table, we identify those sections of the *Canada Elections Act* which are impacted by the electronic voting options (telephone, Internet and kiosk).

On reflection, and after consultation with Elections Canada officials, we have concluded that amendments to the *Act* as listed would only serve to complicate an already difficult and complicated piece of legislation. In fact, the *Act* is so intrinsically linked to the current process that changes would need to be sweeping and widespread. The better course, if Parliament were considering amendments to allow for the possibility of electronic voting, would be to write a new schedule of the *Act* to permit for electronic voting, and under terms and conditions, Parliament deemed appropriate as is the case for special voting rules.

Process Phases	Applicable sections of the <i>Canada Elections Act</i>
1. Registration confirmation	<p>Electoral declaration—Section 120</p> <p>120(1) Each elector, on entering the room where the poll is held, shall declare the elector's name and address whereupon the poll clerk shall ascertain if the name of the elector appears on the official list of electors used at the polling station.</p> <p>120(2) When it has been ascertained that an elector is qualified to vote at a polling station,</p> <p>(a) the electors name shall be struck off the list of electors; and</p> <p>(b) the elector shall immediately be allowed to vote, unless an election officer or any agent of a candidate present at the polling station desires that the elector first show proof of identity or take an oath of qualifications.</p> <p>Manner of voting—Section 131</p> <p>131(1) An elector, before receiving a ballot paper from the DRO, shall give his name and address</p> <p>(a) to the DRO and poll clerk; and</p> <p>(b) on request, to an agent of a candidate.</p> <p>131(4) When an elector has been given a ballot paper, no one shall require the</p>

Process Phases	Applicable sections of the <i>Canada Elections Act</i>
	elector to show proof of identity or take an oath.
2 . Ballot options	<p>Manner of voting—Section 130</p> <p>130(1) Voting shall be by ballot, and each elector shall receive from the DRO a ballot paper, on the back of which that officer has, as prescribed by subsections 117(2) to 117(4), affixed his initials, so placed, as indicated on the back of Form 3, that when the ballot paper is folded the initials can be seen without unfolding the ballot paper.</p> <p>130(2) The DRO shall instruct each elector how and where to affix his mark, shall properly fold the elector’s ballot paper and shall return the elector to return the ballot paper when marked and folded as directed.</p> <p>Manner of voting—Section 133</p> <p>133 An elector who has inadvertently dealt with the ballot paper delivered to him in such a manner that it cannot conveniently be used shall return it to the DRO who shall</p> <p>(a) deface it in such a manner as to render it a spoiled ballot, and</p> <p>(b) deliver another ballot to the elector.</p> <p>133(1) An elector is entitled to receive another ballot paper pursuant to section 133 on not more than one occasion.</p>
3 . Casting of decision	<p>Manner of voting—Sub-section 132(1)</p> <p>132.1 An elector shall, after receiving a ballot,</p> <p>(a) proceed directly to the voting compartment;</p> <p>(b) use the pencil provided, or any other pencil or pen, to make a cross, or other mark that clearly indicates the elector’s choice, in the circular space provided on the ballot opposite the name of the candidate;</p> <p>(c) fold the ballot as instructed by the DRO so that the initials on the back of the folded ballot and the serial number on the back of the stub are visible without unfolding the ballot; and</p> <p>(d) return the ballot to the DRO.</p> <p>132.2 The DRO shall, on receiving the ballot from the elector, (a) without unfolding the ballot, verify that it is the same one that was handed to the elector by examining the initials and serial number on the back of the ballot.</p>
4 . Ballot verification and anonymity of the elector	<p>Manner of voting—Sub-section 132(2)</p> <p>132(2) The DRO shall, on receiving the ballot from the elector; (b) remove and destroy the counterfoil in full view of the elector and all other persons present.</p>

Process Phases	Applicable sections of the <i>Canada Elections Act</i>
5 . Ballot submission	<p>Manner of voting—Section 132</p> <p>132.2 The DRO shall, on receiving the ballot from the elector; (c) return the ballot to the elector who deposits it in the ballot box or, if the elector so requests, the DRO shall deposit the ballot in the ballot box.</p> <p>Proceedings at the poll—Section 125125 Each poll clerk shall (b) indicate on the prescribed form opposite the name of each elector, as soon as the elector’s ballot paper has been deposited in the ballot box, that the elector has voted.</p> <p>Manner of voting—Section 137</p> <p>137(1) Every elector shall vote without undue delay and shall leave the polling station as soon as his ballot paper has been put in the ballot box.</p>
6 . Tabulation of votes	<p>Counting and reporting the votes—Section 160, 161, 162 & 163</p> <p>160(1) Immediately after the close of the poll, in the presence and in full view of the poll clerk and the candidates and their agents, or, if the candidates or any of them are absent, in the presence of those candidates that are present, and of at least two electors if none of the candidates are represented, the DRO shall, in the following order,</p> <p>(a) count the number of electors who have voted, make an entry on the line immediately below the name of the last elector on the list that states “The number of electors who voted at this election in this polling station is (stating the number),” and sign the list;</p> <p>(b) count the spoiled ballot papers, if any, place them in the special envelope supplied for that purpose, indicate thereon the number of spoiled ballot papers and seal it up;</p> <p>(c) count the unused ballot papers undetached from the books of ballot papers, place them with all the stubs of all used ballot papers in the special envelope supplied for that purpose and indicate thereon the number of unused ballot papers;</p> <p>(d) check the number of ballot papers supplied by the returning officer against the number of spoiled ballot papers, if any, the number of unused ballot papers and the number of electors from the list indicated as having voted, in order to ascertain that all ballot papers are accounted for;</p> <p>(e) open the ballot box and empty its contents on a table; and</p> <p>(f) count the number of votes given the each candidate on one of the tally sheets supplied, given full opportunity to those present to examine each ballot paper.</p> <p>160(2) The poll clerk and as many as three witnesses shall be supplied with a tally sheet on which they may keep their own score as each vote is called out by the DRO.</p> <p>161(1) In counting the votes, the DRO shall reject all ballot papers</p>

Process Phases	Applicable sections of the <i>Canada Elections Act</i>
	<p>(a) that have not been supplied to him;</p> <p>(b) that have not been marked for any candidate;</p> <p>(c) on which votes have been given for more than one candidate;</p> <p>(d) that have not been marked in the small circular space, on which the natural colour of the paper appears, at the right of the name of the candidate; or</p> <p>(e) on which there is any writing or mark by which the elector could be identified.</p> <p>161(2) No ballot paper shall be rejected pursuant to subsection (1) by reason only that</p> <p>(a) it has on it any writing, number or mark placed thereon by any DRO; or</p> <p>(b) it has been marked with a writing instrument other than a black lead pencil or with a mark other than a cross, if the mark does not constitute identification of the elector.</p> <p>161(3) Where, in the course of counting the votes, any ballot paper is found with the counterfoil still attached thereto, the DRO shall, while carefully concealing the number thereon from all persons present and without examining it himself, remove and destroy the counterfoil.</p> <p>162(1) Where in the course of counting the votes, a DRO discovers that he has omitted to affix his initials to the back of any ballot paper, as required by subsections 117(2) to (4) and 130(1) and as indicated on Form 3, he shall, in the presence of the poll clerk and the agents of the candidates, affix his initials to the ballot paper and count the ballot paper as if it had been initialed in the first place, if he is satisfied that</p> <p>(a) the ballot paper is one that has been supplied to him;</p> <p>(b) an omission has really been made; and</p> <p>(c) every ballot paper supplied to him by the returning officer has been accounted for, as required by paragraph 160(1)(d).</p> <p>163(1) Each DRO shall</p> <p>(a) keep a record, on the prescribed form, of every objection made by any candidate or the candidate's agent, to any ballot paper found in the ballot box; and</p> <p>(b) decide every question arising out of the objection.</p>
7 . Retention and	Counting and reporting the votes—Sections 164 & 165

Process Phases	Applicable sections of the <i>Canada Elections Act</i>
storage	<p>164(1) All ballot papers that are not rejected by a DRO shall be counted and a list kept of the number of votes given to each candidate and of the number of rejected ballot papers as follows:</p> <p>(a) ballot papers that respectively indicate the votes given for each candidate shall be put into separate envelopes;</p> <p>(b) all rejected ballot papers shall be put into a special envelope;</p> <p>(c) all envelopes referred to in paragraphs (a) and (b) shall be endorsed so as to indicate their contents and shall be sealed by the DRO; and</p> <p>(d) the DRO and the poll clerk shall affix their signatures to the seal and such agents or witnesses present as may desire to do so may sign their names thereon.</p> <p>165(1) Each DRO shall make the necessary number of copies of the statement of the poll in the prescribed form as follows:</p> <p>(a) one copy shall be delivered to the returning officer with the ballot box;</p> <p>(b) one copy, for the returning officer, shall be enclosed in a special envelope supplied for the purpose, sealed by the DRO and deposited separately in the ballot box; and</p> <p>(c) one copy shall be delivered to each of the candidate's agents present at the count.</p> <p>165(2) The envelopes containing the unused, rejected or spoiled ballot papers, or those counted for each candidate, each lot in its proper envelope, the envelope containing the official list of electors and other documents used at the poll shall be placed in the large envelope supplied for the purpose, which shall be immediately sealed and placed in the ballot box with, but not enclosing, the envelope containing the statement of the poll prepared for the returning officer and referred to in subsection (1) and the envelope containing the registration certificates.</p> <p>165(3) The ballot box is to be sealed with the seals prescribed by the Chief Electoral Officer for the use of the DRO and forthwith transmitted to the returning officer.</p>

Appendix C

List of Persons Interviewed

1. Elections Canada and Electoral Systems Experts

Ms Diane Bruyere
Assistant Director of Election
Coordination
Elections Canada

Mr. Michel Hebert
Director of Communications
Elections Canada

Ms Judy Charles
Director of Strategic Planning &
Intergovernmental Affairs
Elections Canada

Mr. Ray Kennedy
Director of Research
International Federation of Electoral
Systems

Ms Susan Clyne
Director of Administration & Human
Resources
Elections Canada

Mr. Jean-Pierre Kingsley
Chief Electoral Officer
Elections Canada

Mr. Tony Coulson
Research Officer
Elections Canada

Mr. Carol Lesage
Director of Operations
Elections Canada

Mr. Wayne Donovan
Former Special Project Director, National
Register of Electors
Elections Canada

Mr. Harold Neufeld
Consultant
DMR Group

Mr. Jacques Girard
Director of Legal Services and Registrar of
Political Parties
Elections Canada

Mr. Garry Saunders
Director of Information Technology
Elections Canada

2. Technology Experts

Mr. Michael E. Cope
Founder and Retired Chairman
INTERPHASE Corporation
Dallas, Texas

Mr. Denny Courier
Strategic Partner Alliances
GE Capital Technology Management
Services
Mississauga, Ontario

Mr. Allan Frank
Chief Technology Officer
Answer Think Consulting Group -
Technology Enabled Solutions
Conshohocken, Pennsylvania

Mr. Jack Hubley
Marketing Vice President of Business
Services and Long Distance Services
AT&T Canada
Toronto, Ontario

Mr. Richard Leonardi
Regional Sales Director
Periphonics
Holbrooke, New York

Mr. Louis H. Milrad
General Counsel
Information Technology Association of
Canada
Richmond Hill, Ontario

Mr. Jerry Shattner
President
Hitachi Data Systems
Montreal, Quebec

Mr. Rick Sola
Senior Director, CTI Systems Integration
Periphonics
Holbrooke, New York

Mr. Francois Thibault
Chief Technology Developer
Periphonics Corporation
Montreal, Quebec

Mr. Richard Timmons
President & CEO
SAGUS Security Incorporated
Ottawa, Ontario

Mr. Claude Wilson
Internet Specialist Global SI Program
IBM
Bethesda, Maryland

Appendix D

Public Policy Forum Roundtable Participants

1. Members of Parliament and Senators

Mr. Reg Alcock
Member of Parliament
Winnipeg South (Manitoba)

Mr. Mark Assad
Member of Parliament
Gatineau-La Lievre (Quebec)

Ms Elinor Caplan
Member of Parliament
Thornhill (Ontario)

Mr. John Godfrey
Member of Parliament
Don Valley West (Ontario)

Mr. John Harvard
Member of Parliament
Charleswood-Assiniboine (Manitoba)

Mr. Peter Milliken
Member of Parliament
Kingston and the Islands (Ontario)

The Honourable Lowell Murray
Senator
(Grenville-Carleton, Ontario)

Ms Karen Redman
Member of Parliament
Kitchener Centre (Ontario)

Mr. Bob Speller
Member of Parliament
Haldimand-Norfolk (Ontario)

Ms Susan Whelan
Member of Parliament
Essex-Windsor (Ontario)

Mr. Ted White
Member of Parliament
North Vancouver (British Columbia)

Dr. David Zussman
President
Public Policy Forum

2. Representatives of voting groups

Dr. Taylor Alexander
President & CEO
Canadian Association for Community Care

Ms Tania Koenig-Gauchier
Metis National Council

Mr. Alan Bacon
Director, Overseas Development
The Salvation Army

Mme Luce Lapierre
Directrice
Federation canadienne de l'alphabétisation
en français

Mr. Derek Barnaby
Urban Multipurpose Aboriginal Youth
Assistant
National Association of Friendship Centres

Ms Dawn Morton
The Ontario Literacy Coalition

Ms Deborah Chapman
Coordinator, Learners Advisory Network
Movement for Canadian Literacy

Mr. Bob Murray
Canadian Council for the Blind

Mr. Kenneth Clements
Parkinson's Society of Ottawa-Carleton

Mr. Vangelis Nikias
National Director, Government Relations
and International Liaison
The Canadian Institute for the Blind

Ms Audrey Cole
Canadian Association for Community
Living

Mr. Rick Price
National Services Coordinator
Canadian Paraplegic Association

Mr. Kamal Firdous
Executive Director
Canadian Council for Multiculturalism and
Multicultural Education

Mr. Rene Rivard
Regional Director
Canadian Hearing Society

Ms Clare Gillespie
Executive Director
Multiple Sclerosis Society of Canada

Ms Terri Tomchyshyn
National Literacy Secretariat

Mr. Dan Haley
Vice-President, Board of Directors
Movement for Canadian Literacy

Mr. Abdi Yunis
Ottawa-Carleton Immigrant Services

Ms Cynthia Knoll
Downs Syndrome Association

3. Selected opinion leaders

Mr. Scott Garvey
Vice President and General Manager,
Central Region
SHL Systemhouse

Mr. John Hollins
Director of Elections
City of Toronto

Mr. John (Jack) C. Hubley
Vice President, Business Services and
Marketing
AT&T Canada

Mr. Dennis G. Kelly
Interim Lead, Elections and Legislative
Services
City of Toronto

Mr. Peter Melanson
Vice President, Electronic Services and
Government Accounts
Canada Post

Mr. Neil Nevitte
Professor, Department of Political Science
University of Toronto

Mr. Bruce Phillips
Privacy Commissioner
Office of the Privacy Commissioner

Mrs. Shirley Serafini
Associate Deputy Minister
Industry Canada

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